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MANUAL TRAINING

Cardboard Construction

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MANUAL TRAINING

Cardboard Construction

BY

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INTRODUCTION.

A Few Principles. — The aim of education is the development of power beneficent to the social organism.

To have power in a certain field of activity is equivalent to reacting in the proper way on stimuli pertaining to that field. We may therefore think of education as having a twofold aim: first, to teach how to react; and second, to secure the taking place of the proper reaction. In other words, the result of education should be knowledge plus will-power.

Let us examine very briefly the role interest in the stimulation plays in regard to these two aspects.

A few quotations from Baldwin's "Mental Development" will throw some light upon how new accommodations are secured, and the relation of interest to the acquisition of knowledge.

The accommodation of an organism to a new stimulation is secured, apart from happy accidents, by the continued or repeated action of that stimulation. We must suppose the development of a function of coördination by which the two regions excited respectively by the original suggestion and the reaction first made coalesce in a common more voluminous and intense stimulation of the motor centre. A movement is thus produced which, by reason of its greater mass and diffusion, includes more of the elements of the movement seen and copied. This is again reported by eye or ear, giving a new excitement which is again coördinated with the original stimulation, and with the after effects of earlier stimulations. The result is yet another stimulation or effort of still greater mass and diffusion which includes yet more elements of the "copy." And so on until simply by its increased mass, including the motor excitement of attention itself, by the greater range and variety of the motor elements thus enervated, — in short, by the excess discharge, — the copy is completely reproduced, the effort being successful. Observe a child trying to accomplish a difficult exercise. His whole

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physical personality becomes concentrated, followed by convulsive discharge upon the member which, by habit or previous use, is nearest to the copy requirement. He rolls his tongue, bites his lip, sways his body, works his legs, winks his eyes, etc., until every scheming nerve and tendon bends to the task.

An examination of the child's earliest voluntary movements shows the growth in mass, diffusion, and lack of precision which this theory requires. In acquiring the associations of elements involved in successful handwriting, for instance, the young child uses hand, then hand and arm, then hand, arm, tongue, face, and finally the whole body.

The effort thus succeeds by the simple fact of increased mass and diffusion of reaction, the useless elements fall away because they have no emphasis. The desired motor elements, on the other hand, are reinforced by their agreement with the copy, by the dwelling of the attention upon them, by the pleasure which accompanies success. Or to restate the above principle of development in another sentence of Baldwin's, it reads: Our organism begins with a susceptibility to certain organic stimulations such as food, oxygen, etc.; these when present give pleasure, the pleasure is, physiologically considered, a heightened vitality in the central nuclear processes; this heightened central vitality issues in a motor discharge; from the resultant, abundant, and varied movements of this excess discharge, those are selected which bring more of these vital stimulations again, and these finally keep up the vitality of the organism and by the repeated excess movements provide for constantly progressive adaptations.

Pleasure, he says, is physiologically considered a heightened vitality in the central nuclear processes, and this increased nervous vitality means, of course, a greater facility for accommodation, that is, a greater facility for acquiring new ideas.

This throws some light in a most general way upon the role interest in the stimulation plays in acquiring knowledge.

The other phase of power is the part played by the will. What significance has interest in the training of the will?

Through the fact that some stimulations appear pleasurable and others painful, there exists on the part of the organism a desire to repeat certain movements or reactions which brought about the pleasurable stimuli. Thus we secure the voluntary repetition of

certain reactions through the attitude of the organism toward previous stimulations.

This shows the intimate relation of interest to the development of will-power. The development of power is therefore conditioned, in the first place, by the attitude of the child toward the stimulation. We have seen that interest means a greater mental activity, and also the possible voluntary repetition of the reaction in the future. The acquisition of knowledge and the training of the will are both to a great extent conditioned by this attitude of interest.

The question how to insure a continued interest is therefore of vital importance. What are the conditions underlying this attitude; in other words, what is interesting?

In a general way it is true that the useful reactions are the interesting ones. If it were not so life would soon disappear. But this general statement helps us little, as we continually see apparent exceptions to that rule.

We may distinguish three stages of interest in the child's life. What gives pleasure at one stage may not at another.

In the earliest childhood the chief source of interest or pleasure, giving rise to innumerable movements, is the healthy activity of function. At a later stage the result of the movement is the vital point. If it is successful, it gives pleasure. The consciousness of power is beginning to appear at that stage, and the organism is beginning to strive for self-realization. That which manifests his power is interesting. At a still later stage past pleasures attained through a certain activity, together with the ease with which the reaction takes place through habits previously formed, will strengthen the impulse to be reacted upon again. In other words, we are interested in what we can do easily and well. Thus interest depends upon power.

The objection might be made that a young child does not care about power, he may not even be conscious of acquiring power through the exercises; he is interested in making something useful for himself or somebody else. On the contrary, the very fact that he is more interested in making a box than a simple square card, for instance, proves that the theory is true. The making of a box which can be used is naturally a manifestation of greater power to the child than the cutting out of a card which might not be useful. He is delighted to show it or give it to a friend, feeling happy and proud

in the consciousness of having produced something. The element of power is at the bottom of this feeling.

By its very nature a continued interest must be a growing one. It must be gradually increasing with the power upon which it is based. It may without so very great harm waver somewhat at first, but it should increase gradually as greater power is attained.

How can we insure this steadily growing interest in manual training?

The progression of the exercises should be such as to manifest to the pupil a constantly growing power. We should never at any stage of the work ask a pupil to do what he cannot do well. His work in manual training should be a line of continuous victories over difficulties gradually increasing, but not surpassing his power at any stage. Continued failure is worse than no attempt at all. Success is a greater factor in the educational value of manual training than in any other subject.

Let us now try to show through a synthetic method how these successive victories over difficulties build up a strong will.

Every individual effort which succeeds in a certain field will add to the consciousness of power in that field. By a certain arrangement of the exercises a boy is able to get high credit for his work. He gets the approbation of the teacher, and, furthermore, and this is probably the stronger factor, he sees for himself that he has been able to do a certain task well. These experiences are repeated time after time. Every one of these successful efforts will add to his consciousness of power in the field in question; in other words, it will add strength to a habit under formation, the moral habit of confidence based upon power.

Confidence means a clear idea of self, that is, a strong will.

Success in a task is the condition for the formation of this habit. The character of the task itself plays only a secondary role.

Manual training is better adapted to further the development of this habit than any other school subject, because the success of the effort is apparent to the pupil. He can see for himself whether he has been successful or not.

It is evident, however, that this habit of confidence is as many sided as there are fields of activity. Manual training will arouse confidence in one's power in anything where similar difficulties are present. Success in arithmetic will develop confidence in one's

power in solving arithmetical problems, etc.; but we can claim for manual training, however, a wide range of application in this respect, on the ground that there are common elements in all fields of manual activity. And in so far as these common elements exist, the confidence gained through a systematically arranged course of manual training can be carried over into other related fields of activity.

There is another more or less general habit which should be the particular outcome of manual training; that is, a certain habit of associating attention with muscular activity. Manual training exercises should be so arranged that attention to the movements of the hand and arm is constantly required to reach the desired result. The necessity of concentrating attention on the movements of the hand, and the muscle sensations arising in the hand and arm to reach this result, will tend to establish a habit of procedure in all manual activity, wherever similar elements enter.

If these results of manual training are to be obtained the progression of the models, the method of teaching, and the character of the pupils' work must conform to the above principles.

THE COURSE.— The following set of models has been planned for the fourth and fifth grades in the Boston public schools. The children in these grades are from eight to ten years of age. The time given to this work is two periods of one hour each a week. It was originally planned for the boys while the girls were sewing, but it has been tried and found successful with classes of girls.

The instruction during the first few models should be given in the form of minute directions, each step being carefully dictated. Later in the course the pupils can work more independently from a drawing of the development of the model, and during the second year a great deal of independent effort on the part of the pupil may be brought out by working from a perspective sketch.

For the educational value of the work, the first few lessons are of the greatest importance. In these the foundation is laid for a certain working method, a certain procedure in doing the work. If the teacher does not emphasize during these earlier lessons, over and over again, that the pupils must work slowly and carefully so as to reach accurate results, the value of the more interesting cutting and pasting exercises later will be seriously impaired.

In the second year numerous parallel models are introduced so as to give an opportunity for choice. The same thing is possible in the first year also, as the number of the models is much greater.

This course would be most successful in the hands of the regular grade teacher, but it would form a legitimate part of the work of the special teacher in drawing.

A working drawing on paper of the development of the model should precede the drawing on the cardboard. This rule should be strictly enforced in the first year and the greater part of the second. Some of the later models in the second year might be drawn directly on the cardboard.

Books in which to make the drawings are desirable, because greater care will be taken by the pupils as to neatness and accuracy, and, as these books will become the property of the pupil, they will lead to activity at home and thus furnish an interesting occupation. A book whose size is especially adapted for the drawings of this course has been prepared, in which perspective sketches of some of the models are given. These sketches will add interest to the work, and, far from serving as something to copy, they will lead to independent activity by furnishing the pupils with problems of constructing the development of a model from a perspective sketch.

The first experiments with this course were begun in the Prince and Horace Mann Schools in 1897, and the authors wish to acknowledge their indebtedness to the principals of these schools for assistance and encouragement during the earlier experimental stage of the work.

The problem of manual training in the lower elementary grades is one that at present attracts a great deal of attention. The value of the subject in these lower grades has until lately been almost overlooked. We believe the time is coming, however, when the relative value of manual training in the different grades will be examined with greater care, and we are confident that the verdict will be that the educational value of manual training will be found greatest in these lower grades.

This work has been compiled in the hope that it may prove of some help in solving this important problem of manual training.

BOSTON, June, 1899.

EXERCISES, INSTRUMENTS, AND MATERIAL.

USE OF SCISSORS. — Hold the scissors with the thumb and second finger.

Cut slowly on the line with light coming from the left.

Begin to cut as near the pivot as possible and avoid cutting the whole length of the blade. The cutting action of the scissors can be better controlled if only short distances are attempted with each cut.

The scissors should open with ease, but the joint must not be too loose. It is well to have a piece of cloth to wipe off the scissors after and particularly before using, as the dust which may have collected between the blades often makes the scissors open with difficulty.

Good scissors can be bought for $1.80 to $3 a dozen, and no cheaper ones should be used for this work. Scissors five to six inches in length are convenient sizes.

Select such as have one blunt point. After having been sharpened this is used for scoring in the second year.

FOLDING.—In folding place one edge of the rule on the dotted line, and with the fingers placed under the cardboard bend it upward towards the rule, creasing it to an angle of ninety degrees. Then remove rule and press the crease more firmly. In creasing small surfaces, like laps for instance, it is well to use a small paper folder instead of the fingers for bending the cardboard.

The above applies to the folding in the first year and the first eight models of the second year. For the rest of the models in the second year a thicker grade of cardboard is used, and the folding is done after scoring with the blunt point of the scissors.

PUNCHING. — This exercise is done with an ordinary conductor's punch, which makes a hole $\frac{1}{8}''$ diameter. It is desirable to have one punch to every six pupils in the class. After having located the places for the holes each pupil in turn can punch the holes in his model.

TYING. — The pupils should be taught how to tie a square knot. This might best be illustrated to the class by showing the position of the two ends with a thick piece of string or cord.

Knitting cotton serves the purpose best because it fills up the holes and so gives a good appearance to the model, but any kind of twine may be used.

PASTING. — It is a good plan to have each pupil supplied with a five-cent tube of photo-library paste, but a far more inexpensive, although not so convenient, way is to buy large tubes and distribute the paste on pieces of paper. It may be conveniently applied with a tooth-pick or a small strip of cardboard.

In pasting some of the larger models where several surfaces are fastened together, it is well to apply the paste to one or two surfaces at a time and then hold them together for half a minute, and afterwards continue pasting the other surfaces in the same way, instead of applying all the paste at once.

SCORING.— This exercise consists in cutting half through the cardboard to make folding easier.

The best tool for this is the knife, but the use of scissors for the purpose would prove perfectly satisfactory, if the blunt point of one of the blades is sharpened for the purpose. This exercise should not be introduced before Model 9, Second Year.

CARDBOARD. — Two thicknesses of cardboard are used. For the first year and the first eight models of the second year's course, the weight is 100 pounds to 500 sheets. For the rest of the second year, 140 pounds to 500 sheets.

It may be secured of different shades and colors. The gray varieties will be found the best for the majority of the models. In selecting the thinner cardboard see that it can be creased without breaking.

DRAWING. — To make exact cutting possible it is necessary to have fine distinct lines. A hard pencil is therefore preferable, although not so hard that it will tear the paper or cardboard.

For the first year it is best to have a rule giving $\frac{1}{8}''$ as the smallest fraction, but for the second year $\frac{1}{16}''$ is necessary.

If only one triangle is supplied the 45° is preferable. The size should be 6″ or larger.

The following lines are used in the drawings:

Heavy solid lines for the outline of an object.

Light solid lines for construction lines.

One-half inch dash lines for dimension lines. These lines should be light and made of dashes about $\frac{1}{2}''$ long with $\frac{1}{8}''$ spaces between them.

One-eighth inch dash lines for extension lines and to indicate folding. They are made of dashes about $\frac{1}{8}''$ long with $\frac{1}{8}''$ spaces between them.

In placing dimensions upon a drawing a dash line should be drawn from one point to another between which the dimension is to be given, and the actual dimension should be placed in the line, a space having been left for it in the centre.

Arrow-heads are placed at the ends of these lines, the points of the arrow-heads exactly touching the points or lines between which the dimension is to be given.

The figures for dimensions should read from the left or from the bottom of the drawing.

The dividing line in a fraction should always be made in line with the dimension line. Place the dimension lines at least $\frac{1}{4}''$ outside the figure.

When an arc of a circle is shown, give the radius, and draw a very small circle about the centre, and let this small circle take the place of an arrow-head.

PRELIMINARY LESSONS.

In large classes it will be found advisable to introduce the work with a few preliminary lessons. The following are suggested:

1st	lesson.	The use of rule as a measuring instrument.
2d	"	The use of rule for drawing lines.
3d	"	The use of rule for drawing lines of definite lengths.
4th	"	Use of triangle.
5th	"	Use of scissors.
6th	"	On the different lines.

The time given to the preparatory lessons would be determined by the amount of time given to manual training. If two periods of one hour each are given to the work, it would be well to give one period to each of the lessons. If only one period a week is given, these lessons must be gone through more rapidly.

LESSON I. Use of rule for measuring.

Instrument: rule.

Draw an oblong on the blackboard about $36'' \times 3''$, representing the rule.

Divide into twelve equal spaces and write figures as on the rule.

Show to class that these distances represent inches.

Have some of the pupils come to the blackboard to point out distances in inches asked for by the teacher.

Explain the sign for inches, two dots, and the sign for feet, one dot.

Have the class show on their rules distances asked for by the teacher.

Call attention to the lines on the rule indicating $\frac{1}{2}''$, these being the longest lines between the inch marks.

Complete the rule on the blackboard by putting on these lines.

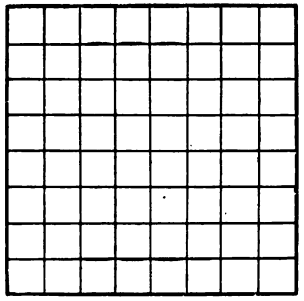
Have individual pupils point out upon the blackboard distances involving the $\frac{1}{2}''$ fraction, the class being asked to show the same distances on their own rules.

Have the class find the dimensions of objects, as books, the top of the desk, etc.

Teach the dimensions, length, width, and thickness.

LESSON II. Use of rule for drawing lines.

Instruments: pencil, rule.



Give the class pieces of paper about 6″ square.

Show pupils how to hold rule when drawing lines.

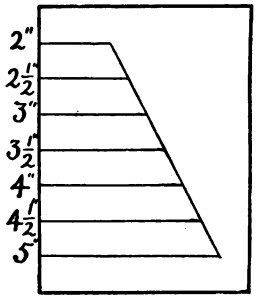
Direct the pupils to measure 1″ from the top on the right and left edges and draw to a horizontal line connecting these points.

Continue drawing horizontal lines 1″ apart to the bottom of the paper, dictating each step.

Draw the vertical lines 1″ apart.

LESSON III. Drawing lines of given length.

Instruments: pencil, rule.



Draw a horizontal line 1″ from the top, and a vertical line 1″ from the left side of paper.

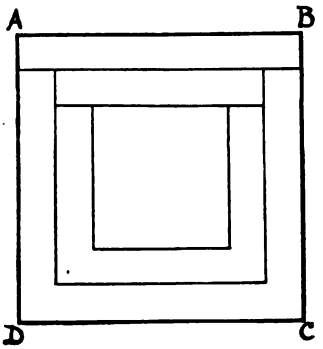
Measure off $\frac{1}{2}''$ spaces on the vertical line, beginning at the intersection point.

At the right edge of paper measure $\frac{1}{2}''$ spaces below the horizontal line.

Write opposite the dots at the left side the required lengths of the lines to be drawn, making each line $\frac{1}{2}''$ shorter than the one preceding it. If accurately done, a line drawn through the ends of these lines should be straight.

LESSON IV. Use of triangle.

Instruments: pencil, rule, triangle.



Draw horizontal line AB 6″ long.

Place the triangle so that one of the short sides coincides with AB with the right angle at B, draw the line BC.

In the same way draw the line AD with the triangle.

Measure off 6″ on these perpendiculars from B and A respectively, draw the line DC.

Draw horizontal line 1″ below AB, and construct a concentric square, using triangle as before.

LESSON V. Use of scissors.

Instruments: pencil, rule, triangle, and scissors.

The squares drawn in the previous lesson may be cut out in this one.

Show how to hold scissors.

It is not a good plan to draw a number of lines on a piece of paper and then ask the class to cut on them. This method will have a tendency to make the pupils careless in the following exercises. Give them something definite to cut out as suggested above. The success they may have in the future does not so much depend upon the amount of cutting they have had as upon the character of their previous work. It is better preparation to have cut carefully on one single line than to have carelessly used the scissors on a hundred. The teacher will have to remind the pupils repeatedly to cut slowly during the earlier lessons.

LESSON VI. On the different lines.

As there are four different lines used in the following drawings, it seems best to concentrate the attention of the pupils during one lesson on the character and use of these lines. The teacher may make a drawing on the blackboard in which the typical use of each line, except the folding line, is shown, and explain reason for having so many different lines. Then the class may draw the lines on paper.

NOTE. This lesson had better be postponed until after the first model is made. Then the pupils will know the length of one-half inch. For the extension lines it will be sufficient at this stage to ask the pupils to make short dashes.

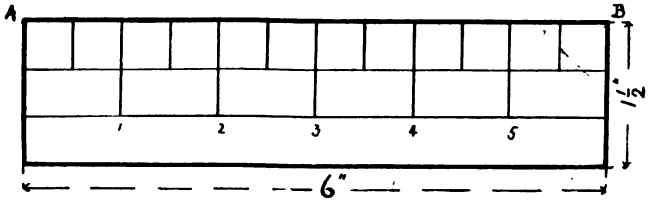
FIRST YEAR.

PLAN OF THE EXERCISES.

FIRST YEAR.

Exercises.	Models.
Cutting with Scissors.	No. 1. Rule.
	" 2. Square Card.
	" 3. Tag.
	" 4. Circular Card.
	" 5. Equilateral Triangle.
	" 6. Isosceles Triangle.
	" 7. Scalene Triangle.
	" 8. Hexagonal Card.
	" 9. Hexagonal Star.
	" 10. Octagonal Card.
	" 11. Rule.
	" 12. Circle-Maker.
	" 13. Rhombus.
	" 14. Rhomboid.
	" 15. Quatrefoil.
	" 16. Rule.
	" 17. Hem Measure.
	" 18. Trefoil.
	" 19. Table Mat.
	" 20A. Book-Mark.
	" 20B. Book-Mark.
Cutting and Folding.	" 21. Sled.
Cutting, Folding, and Tying.	" 22. Book-Mark.
	" 23. Square Box.
	" 24. Wall Pocket.
	" 25. Cubical Box.
	" 26. Catch-All.
	" 27. Handkerchief Box.
	" 28. Candy Box.
	" 29. Basket.
	" 30. Candle Shade.
	" 31. Portfolio.
	" 32. Hexagonal Tray.
	" 33. Frame.
	" 34. Square Candy Box.
	" 35. Frame.
	" 36. Cabinet Frame.
	" 37. Brush-Broom Holder.
	" 38. Court-Plaster Case.
	" 39. Letter Holder.
	" 40. Card Basket.

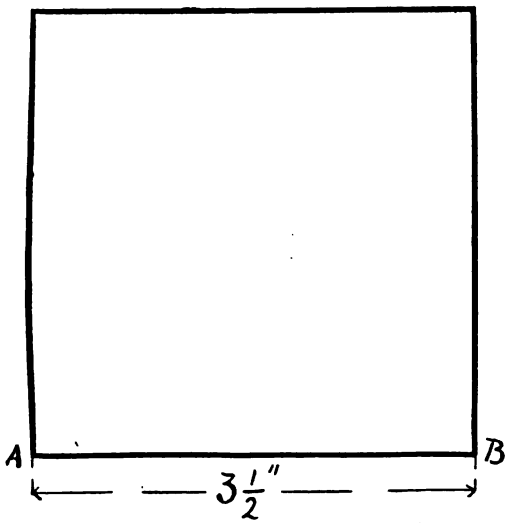
No. 1. RULE. First Year.



1. Draw a horizontal line 6″ long.
2. Erect perpendiculars at each end, using triangle.
3. Complete rectangle.
4. Mark off distances 1″ down from A and B, and connect with a horizontal line.
5. Mark off 1″ distances on AB, and erect perpendiculars at these points to the horizontal line just drawn.
6. Draw another horizontal line ½″ from AB.
7. Mark off ½″ distances on AB, and erect perpendiculars to this line.

NOTE.—Teach the qualities of a rectangle, parallel horizontal and parallel vertical lines and accurate measurements.

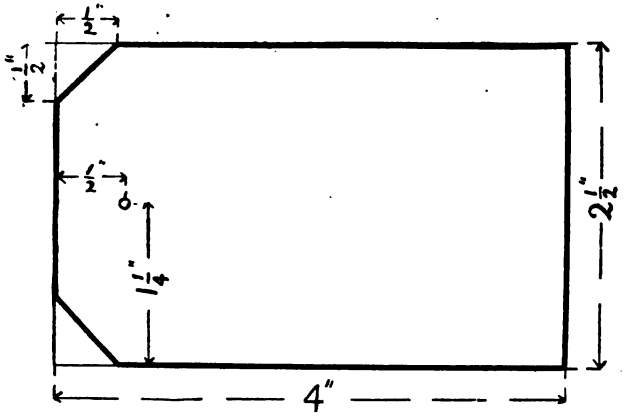
No. 2. SQUARE CARD. First Year.



1. Draw a horizontal line $3\frac{1}{2}$″ long.
2. Erect perpendiculars at A and B, using triangle.
3. Complete square.

NOTE. - Teach the qualities of a square.

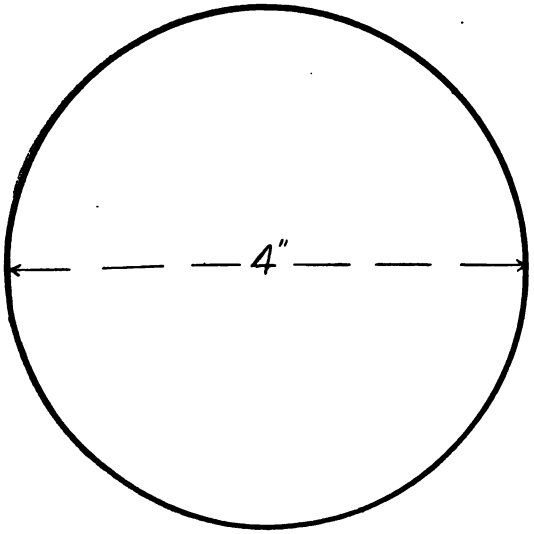
No. 3. TAG. First Year.



1. Construct rectangle 4″ × 2½″.
2. Mark off for corners and find place for hole.

NOTE.—Review facts illustrated in previous lessons. The two small triangles cut from the corners, when put together will make a square.

No. 4. CIRCULAR CARD. First Year.

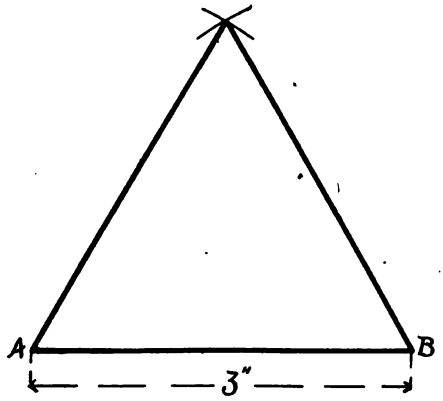


Describe a circle, 2″ radius.

NOTE.—A preliminary lesson may be given on the use of the compasses. Teach the characteristics of a circle and terms used in connection with the same, as centre, radius, diameter, circumference.

This model may be used as a mount for a calendar.

No. 5. EQUILATERAL TRIANGLE. First Year.



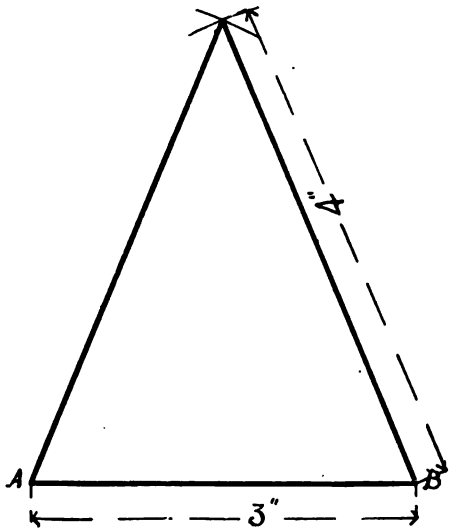
1. Draw the horizontal line AB.
2. Take A as a centre and AB as radius and describe arc.
3. Take B as centre and same radius and describe arc.
4. Connect point of intersection with A and B.

NOTE.— Teach characteristics of a triangle.
Compare with other triangles and give name "equilateral."

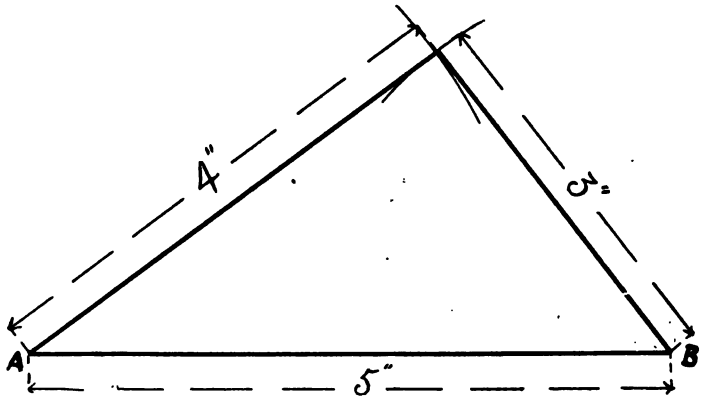
No. 6. ISOSCELES TRIANGLE. First Year.

1. Draw the base AB.
2. With centre A and radius greater than one-half of AB (in this case 4") describe an arc. With centre B and same radius describe arc.
3. Connect the point of intersection with A and B.

NOTE. — Teach the characteristics of the isosceles triangle.



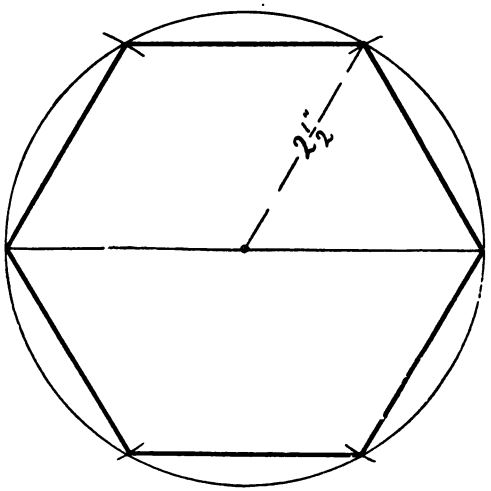
No. 7. SCALENE TRIANGLE. First Year.



1. Draw horizontal line AB, 5″ long.
2. With centre A and radius 4″ describe arc.
3. With centre B and radius 3″ describe arc.
4. Connect point of intersection with A and B.

NOTE.— Compare with triangles previously constructed.

No. 8. HEXAGONAL CARD. First Year.

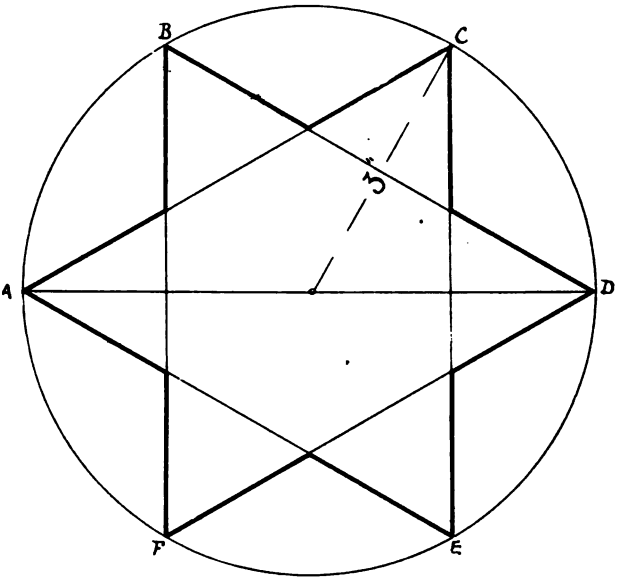


1. Describe a circle, radius 2½″.
2. Draw the horizontal diameter.
3. Set off radius on the circumference from extremities of diameter.
4. Connect the points, completing the hexagon.

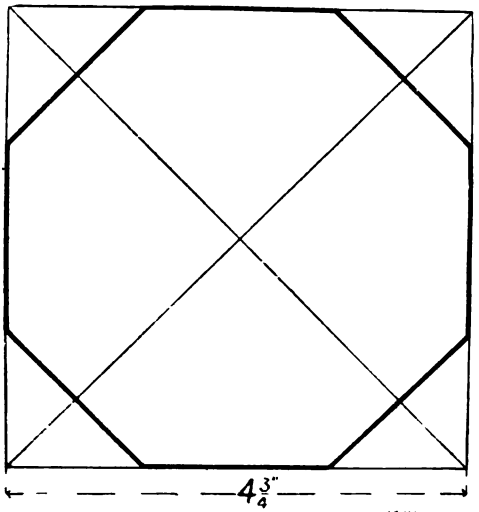
NOTE.—Teach the qualities of a hexagon and its construction. Compare angles with right and acute.

No. 9. HEXAGONAL STAR. First Year.

1. Describe a circle, radius 3″.
2. Set off the radius on the circumference, as in No. 8.
3. Draw the triangles ACE and BDF.
4. Darken the outline of the star.

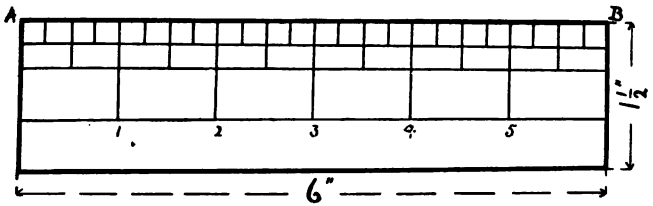


No. 10. OCTAGONAL CARD. First Year.



1. Construct the square.
2. Draw the diagonals.
3. With half the length of the diagonal as radius and the corners of the square as centres describe arcs, locating the corners of the octagon.
4. Connect points, completing the octagon.

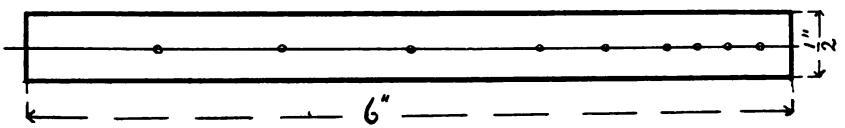
NOTE.—Teach the characteristics of the octagon, sides and angles.



1. Construct rectangle and mark inches and half inches. (See Model No. 1.)
2. Draw horizontal line $\frac{1}{4}''$ from AB.
3. Mark off $\frac{1}{4}''$ spaces on AB and draw perpendiculars through these points to line just drawn.

NOTE.— Additional practice may be given in the use of the $\frac{1}{4}''$ fraction. (See note, Model No. 16.)

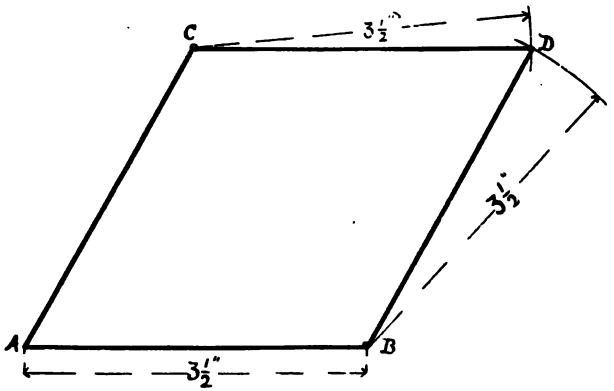
No. 12. CIRCLE-MAKER. First Year.



1. Construct rectangle.
2. Draw the centre line.
3. Divide the line into inches.
4. Divide the first inch into quarters and the second inch into half inches.
5. Punch holes with a pin.

NOTE. — Place a needle-point in one of the holes, and with a pencil-point placed in another hole circles of different sizes may be made by revolving the circle-maker around the needle-point.

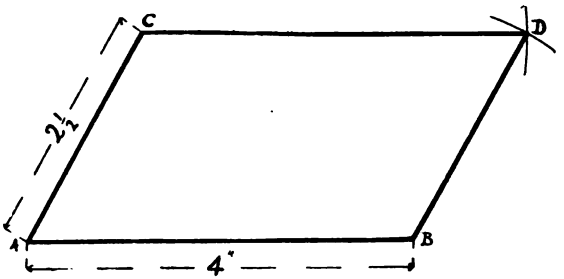
No. 13. RHOMBUS. First Year.



1. Draw the base AB.
2. Draw an oblique line AC, length = AB, through A at any convenient angle to AB. (60°.)
3. Take AB as radius and B and C respectively as centres and find D.
4. Connect D with B and C.

NOTE.— Teach the qualities of a rhombus and compare with square. It may prove convenient to construct an equilateral triangle on AB, thus getting the 60° angle at A.

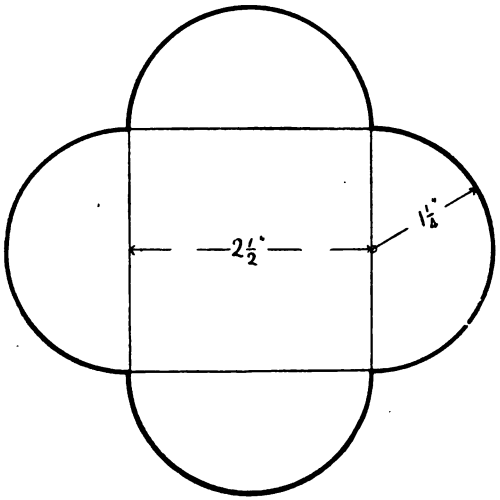
No. 14. RHOMBOID. First Year.



1. Draw the base AB.
2. Draw AC at any convenient angle to AB. (60°.)
3. With C as centre and AB as radius describe arc.
4. With B as centre and AC as radius describe arc, the two intersecting at D.
5. Connect D and C, and D and B.

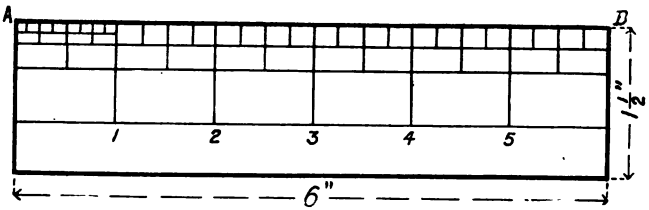
NOTE.— Teach the qualities of rhomboid ; compare with rectangle.

No. 15. QUATREFOIL. First Year.



1. Construct square, side $2\frac{1}{2}$".
2. Find centre of each side and construct semicircles.

No. 16. RULE. First Year.



1. Construct as in Models No. 1 and No. 11.
2. Draw a line $\frac{1}{8}$" from the base.
3. Set off $\frac{1}{8}$" distances on the base and draw the perpendiculars.

NOTE.— Give some exercises using the $\frac{1}{8}$" fraction.
Instead of making this model, the $\frac{1}{8}$ fraction may be drawn on Model No. 11.

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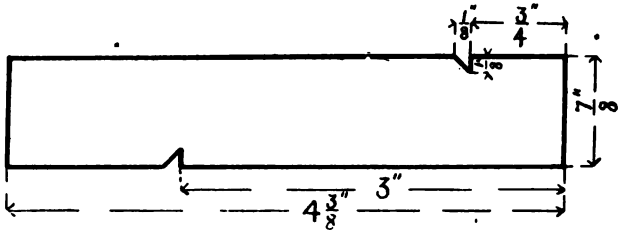
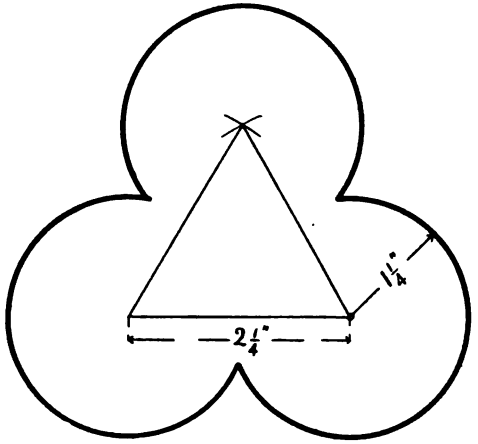
No. 17. HEM MEASURE. First Year.



1. Construct the rectangle.
2. Mark off a distance $\frac{3}{4}$" from one end on one side, and 3" on the other side, and make the drawing for the notches.

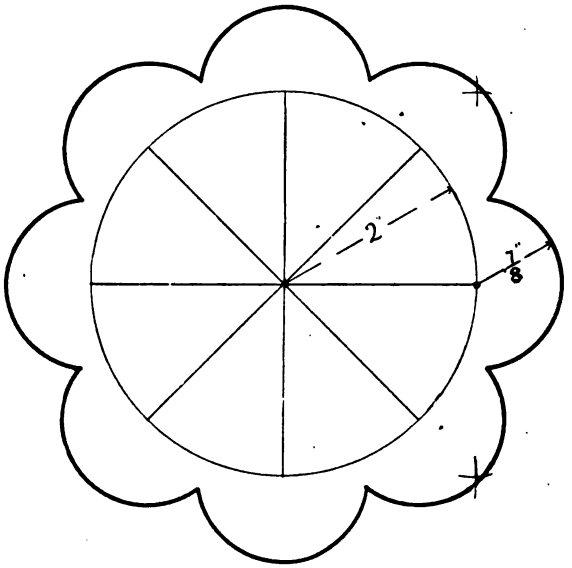
NOTE. — Explain its application in Sewing.

No. 18. TREFOIL. First Year.



1. Construct an equilateral triangle, side $2\frac{1}{4}$".
2. With corners of triangle as centres and $1\frac{1}{4}$" radius describe the arcs.

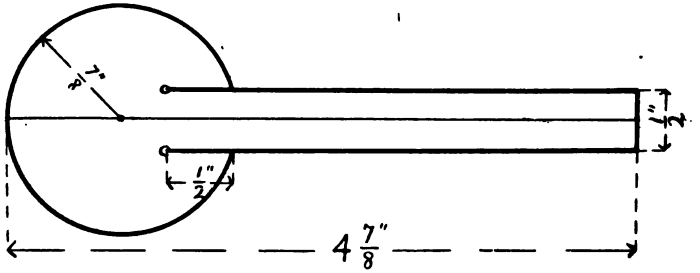
No. 19. TABLE MAT. First Year.



1. Describe a circle, 2″ radius.
2. Draw the horizontal and vertical diameters.
3. Bisect quadrants, using the compasses, and draw the diameters.
4. With extremities of diameters as centres describe the arcs forming the outline of the model.

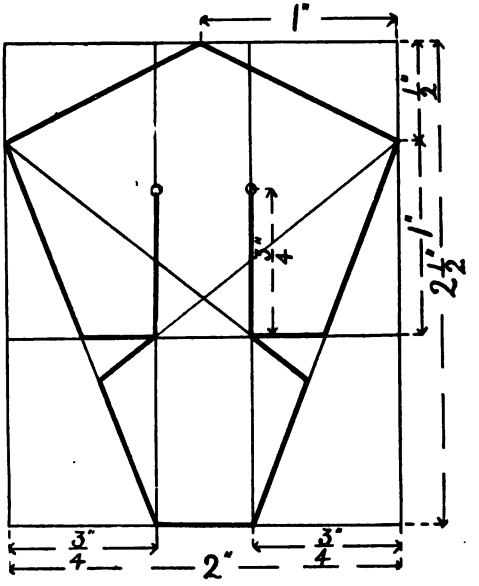
NOTE. —Teach how to bisect a line.

No. 20A. BOOK-MARK. First Year.

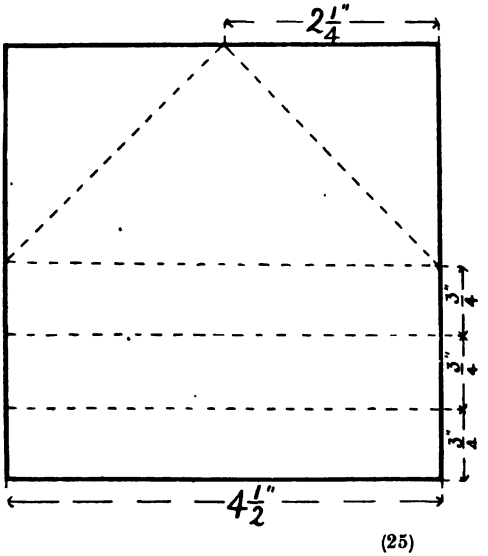


1. Draw a horizontal line $4\frac{7}{8}$″ long.
2. From one end set off radius $\frac{7}{8}$″ and describe circle.
3. Draw lines parallel to the horizontal line, $\frac{1}{4}$″ from it, on each side, and complete end of model by vertical line.
4. Have the parallel lines just drawn extend $\frac{1}{2}$″ within the circular part.
5. Small holes may be punched at the extremities of these lines.

1. Construct rectangle $2\frac{1}{2}'' \times 2''$.
2. Draw lines inside parallel to the sides.
3. Mark off distances and draw oblique lines, completing the outline of the model.

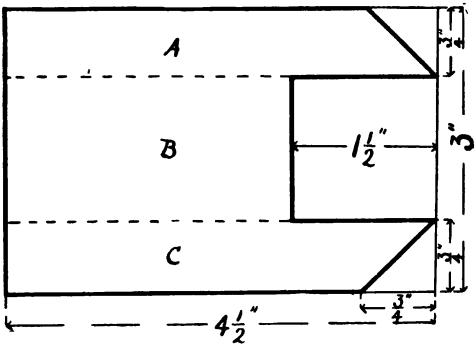


FOLDING EXERCISE.



1. Construct square $4\frac{1}{2}''$.
2. Draw dotted lines (see page 11).
3. Fold on dotted lines (see page 9).

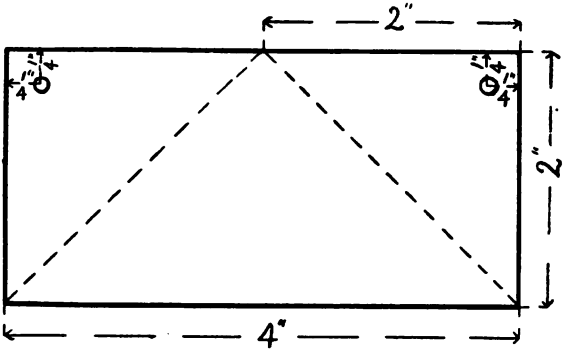
No. 21. SLED. First Year.

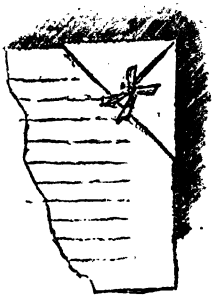


1. Construct the rectangle $4\frac{1}{2}'' \times 3''$.
2. Draw folding lines and complete outline of the model.
3. On the $\frac{1}{8}''$ dash lines fold the parts A and C at right angles to B.

NOTE.—In all the following models, it is well to darken the outline of the figure to be cut out.

No. 22. BOOK-MARK. First Year.



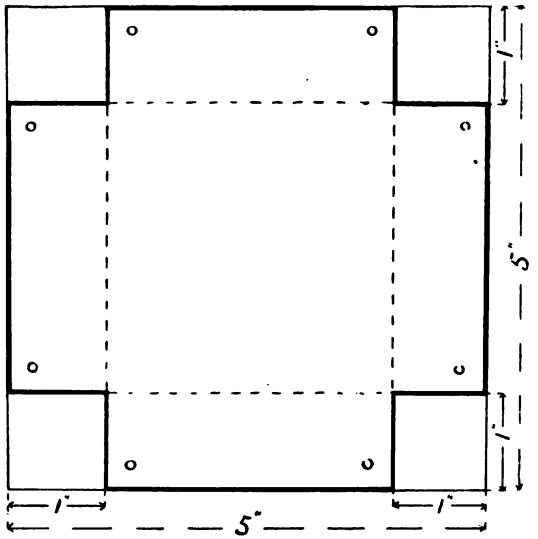


1. Construct the rectangle $4'' \times 2''$.
2. Find the centre of one of the long sides and connect it with the ends of opposite side.

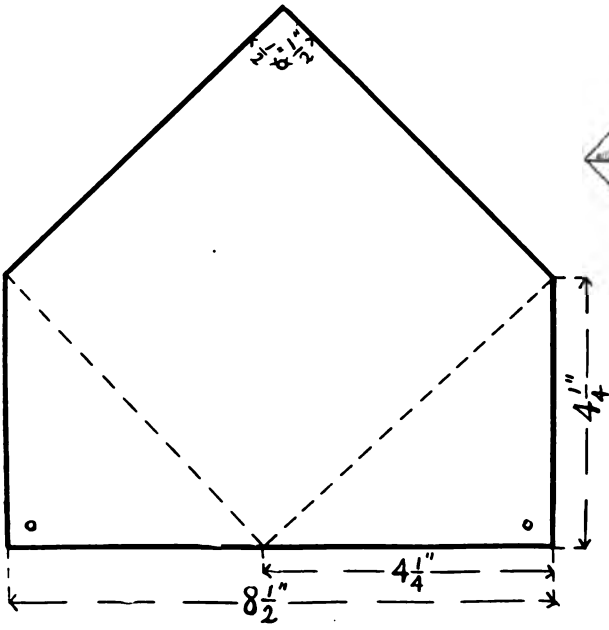
NOTE.—Tie together folded parts with twine or knitting cotton.
The holes for tying are $\frac{1}{4}''$ from the edge on this and the following models, when the distances are not dimensioned.

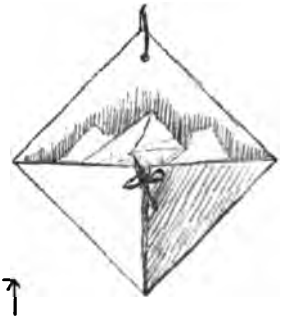
No. 23. SQUARE BOX. First Year.

Construct square 5" and draw lines inside square.

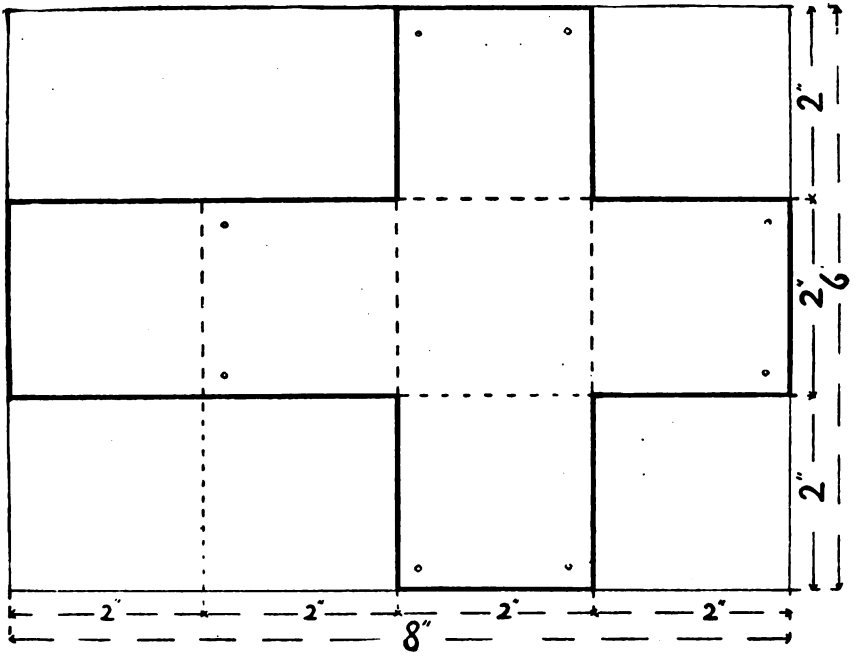


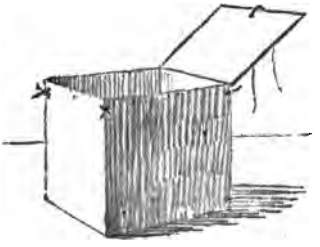
No. 24. WALL POCKET. First Year.





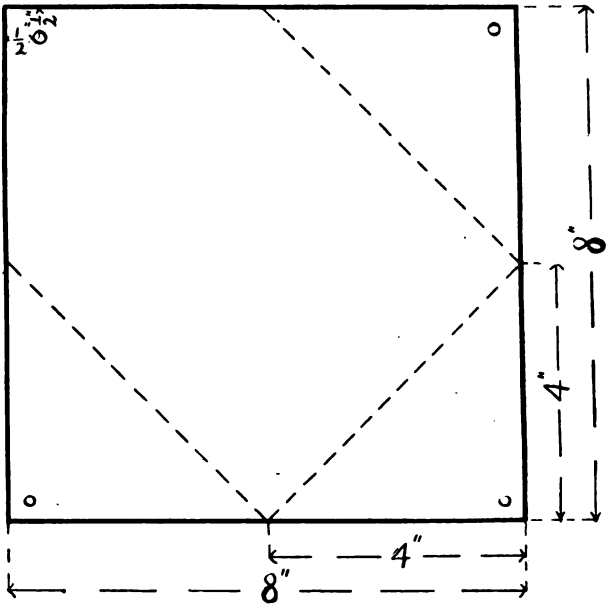
1. Construct square $8\frac{1}{2}$".
2. Find centre of sides, and connect.





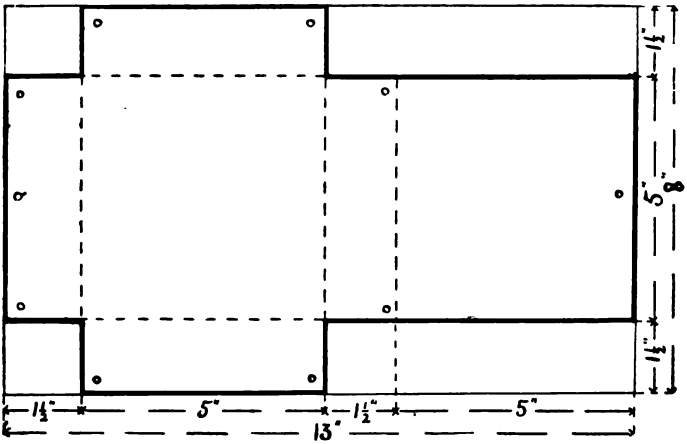
1. Construct rectangle 8″×6″.
2. Divide sides into two-inch spaces and connect opposite points.

No. 26. **CATCH-ALL.** **First Year.**

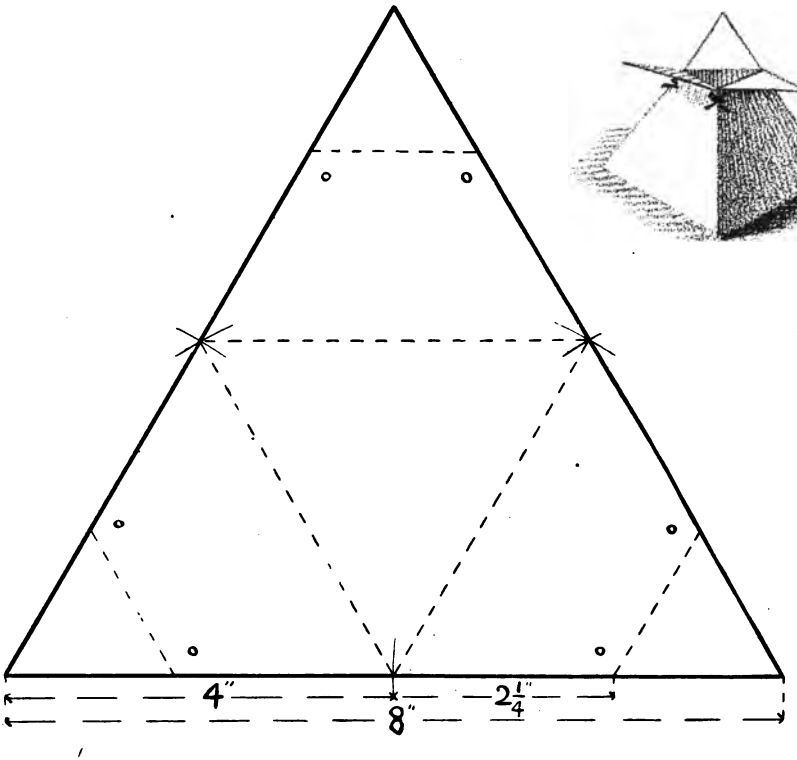


1. Construct square 8″.
2. Find centres of sides and connect.

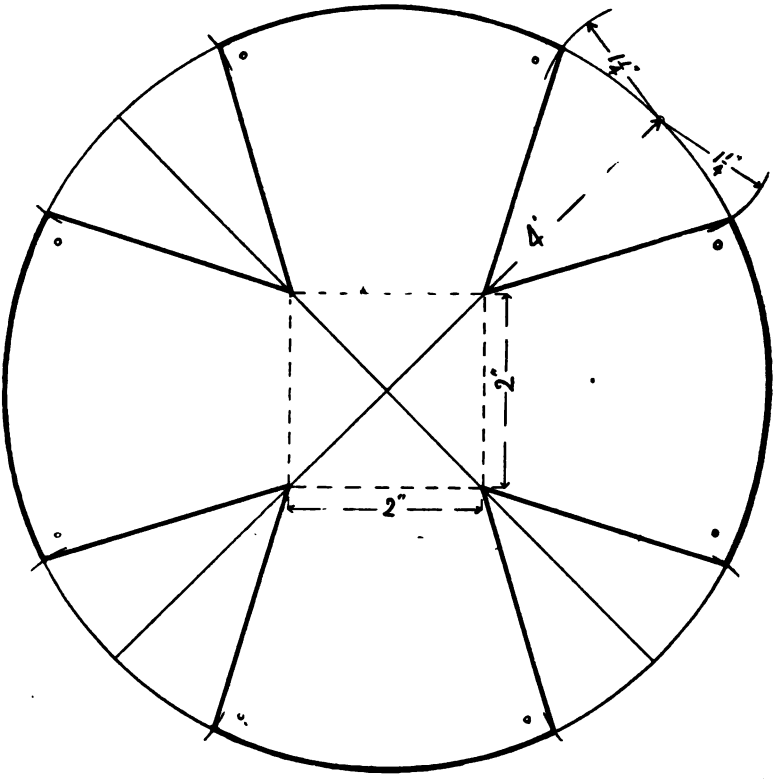
No. 27. **HANDKERCHIEF BOX.** **First Year.**



1. Construct rectangle 13″×8″.
2. Measure off on long sides 1½″, 5″, 1½″ spaces; on short sides 1½″ and 5″ spaces.
3. Connect opposite points.

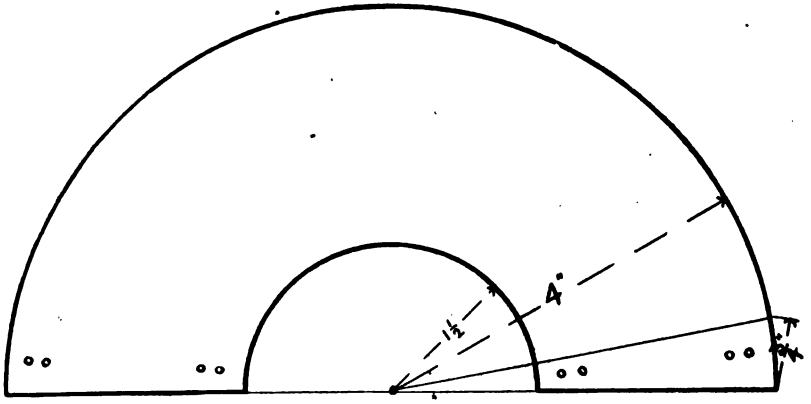


1. Construct equilateral triangle, 8″ base.
2. Connect centres of sides with dotted lines.
3. Draw dotted lines 2¼″ from and parallel to those just drawn. measuring on the sides. These last lines should be on the other side of the cardboard, therefore they have to be drawn on the cardboard after the 8″ triangle is cut out.



1. Construct 2″ square, and draw diagonals.
2. With radius 4″ and centre the intersection point of the diagonals describe circle.
3. Extend diagonals to circumference of circle.
4. Measure off 1¼″ on the circumference on each side of the diagonals, using compasses.
6. Connect these points with corresponding corners of the square.

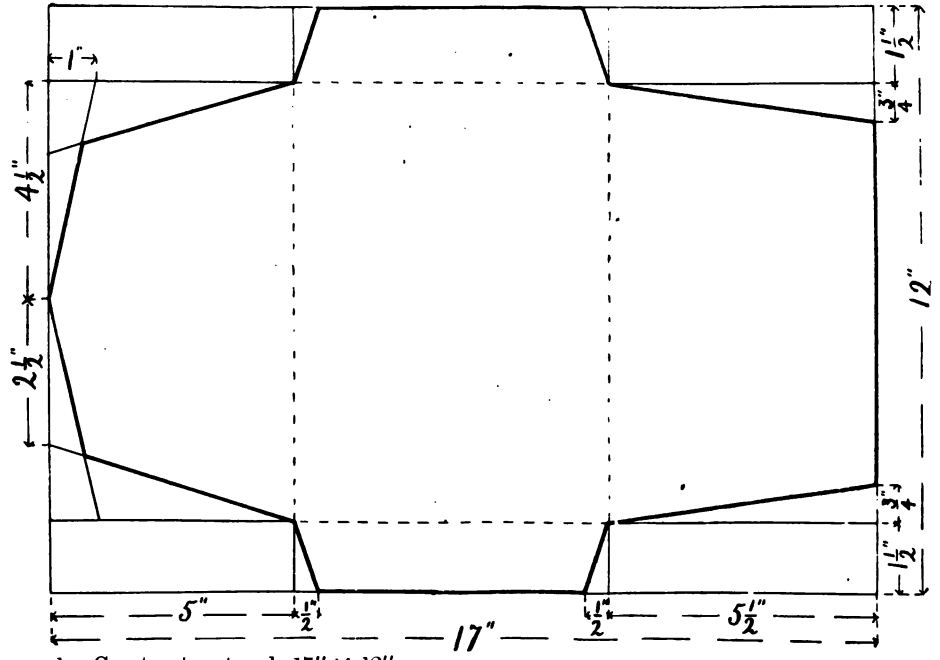
No. 30. CANDLE SHADE. First Year.



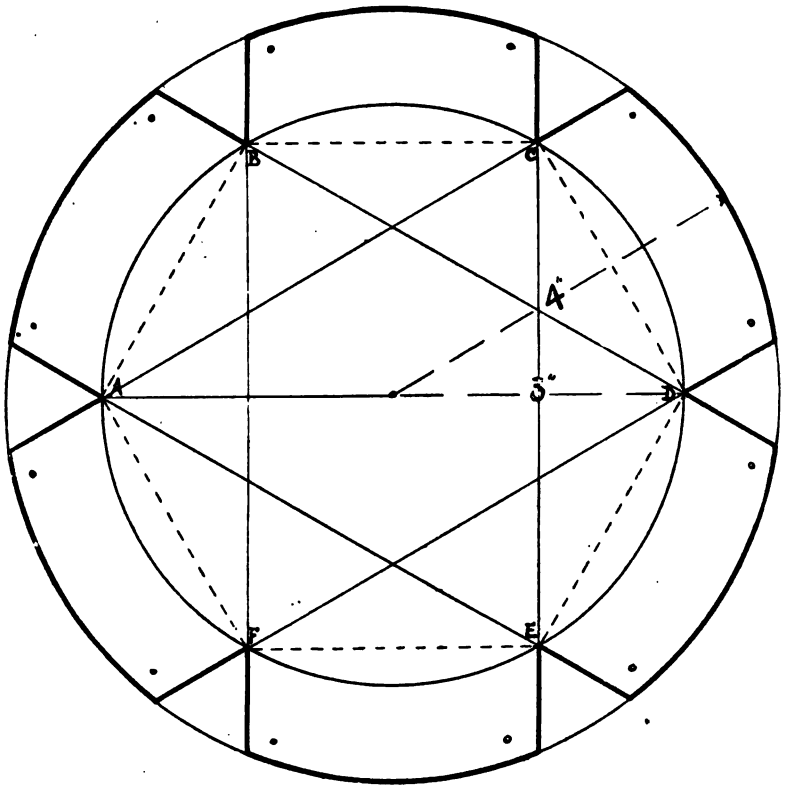
1. Construct semi-circle, radius 4″.
2. With same centre construct another semi-circle, radius 1½″.
3. Indicate the overlapping part by a line from the centre to a point on the large arc ¾″ from the diameter.

NOTE. — Place the two ends so that they overlap to the line drawn, and punch holes through both thicknesses of cardboard at the same time.

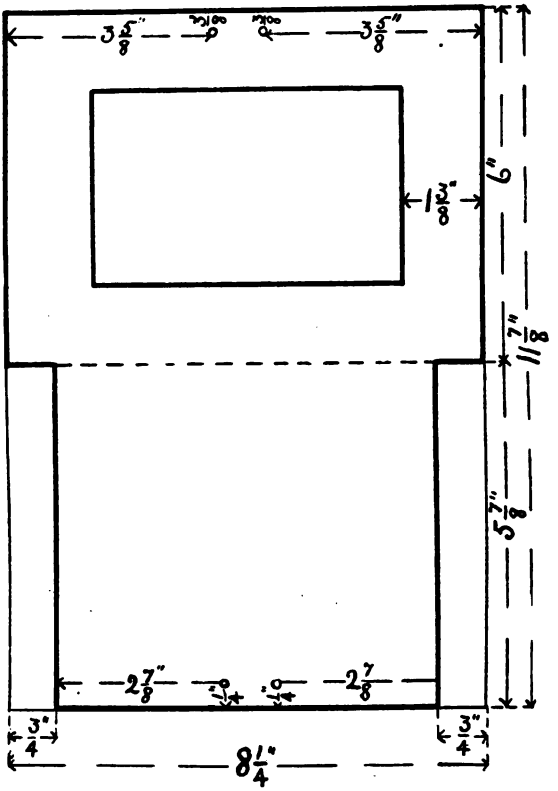
No. 31. PORTFOLIO. First Year.



1. Construct rectangle 17″ × 12″.
2. Draw lines inside parallel to sides.
3. Complete outline of laps.

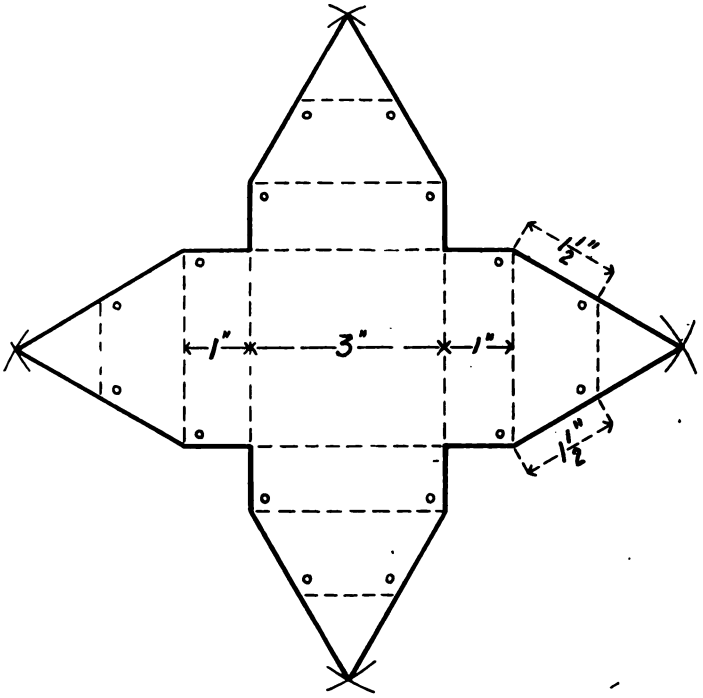


1. Describe concentric circles, radii 4″×3″ respectively.
2. Inscribe hexagon in smaller circle.
3. Draw triangles ACE and BDF.
4. Extend the sides of these triangles to the circumference of the other circle.

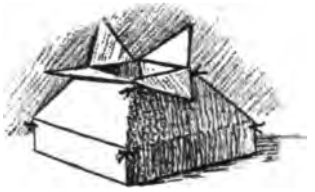


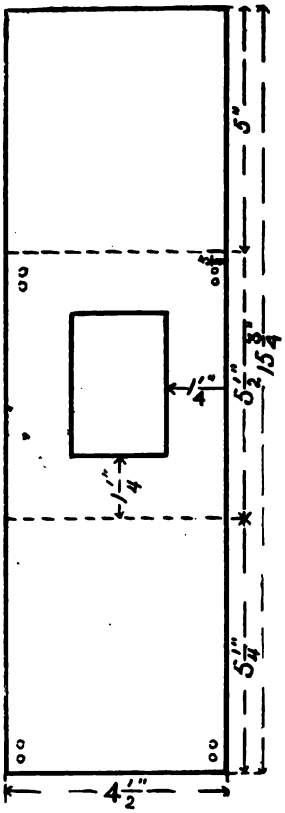
1. Construct rectangle $11\frac{7}{8}'' \times 8\frac{1}{4}''$ and complete according to drawing.
2. To facilitate the cutting, the inside rectangle indicating the opening for the picture should be drawn on both sides of the cardboard. To get this drawing accurate it may be a good plan to perforate the cardboard with a pin or needle point in the corners of the rectangle and then connect the points attained on the other side of the cardboard.
3. In cutting out the opening of the frame, make a hole with the scissors in the centre and cut on the diagonals to the four corners. Then, with the scissors held underneath the frame, always cut on the left side of the opening to be made, beginning near the centre of the line, and cut up to the corner. Having cut the four sides that way, turn the model over and repeat the same cutting from the other side.

NOTE. — If this exercise is being done with the scissors while reading the directions they will seem less obscure.

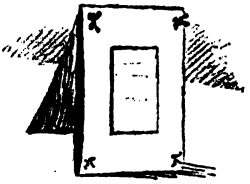


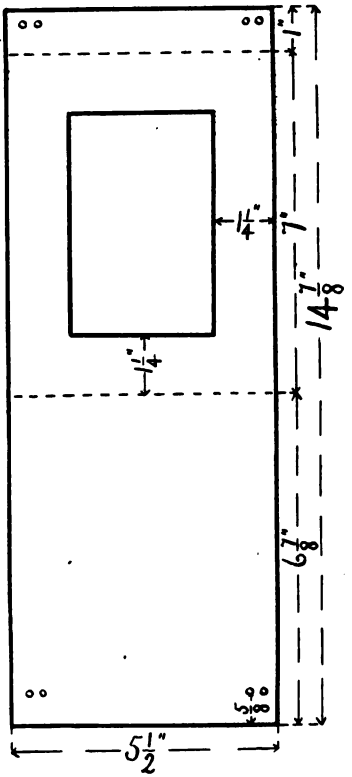
1. Construct square 3″.
2. Extend sides 1″ and connect.
3. Construct equilateral triangles on lines just drawn.
4. Cut out the model.
5. Draw dotted lines for laps on other side of cardboard.



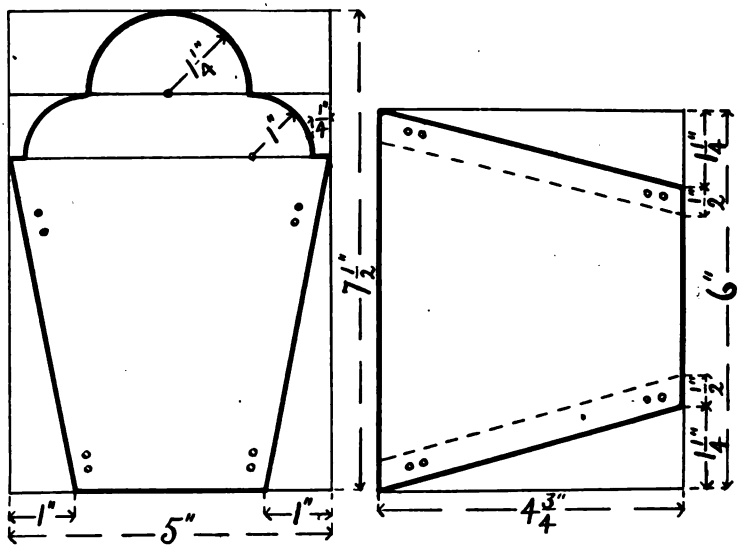


No. 35.





No. 36. Cabinet Frame.

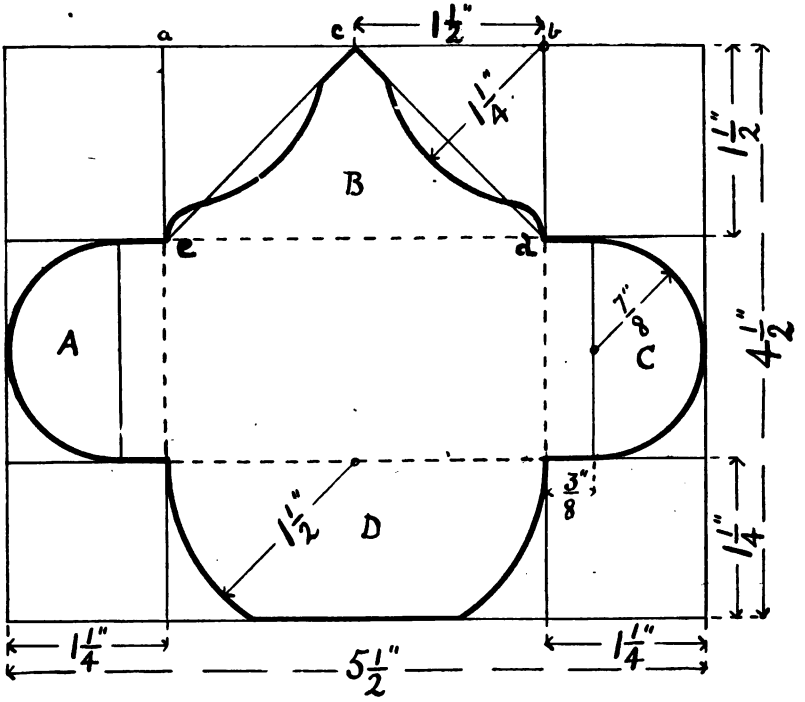


Back.

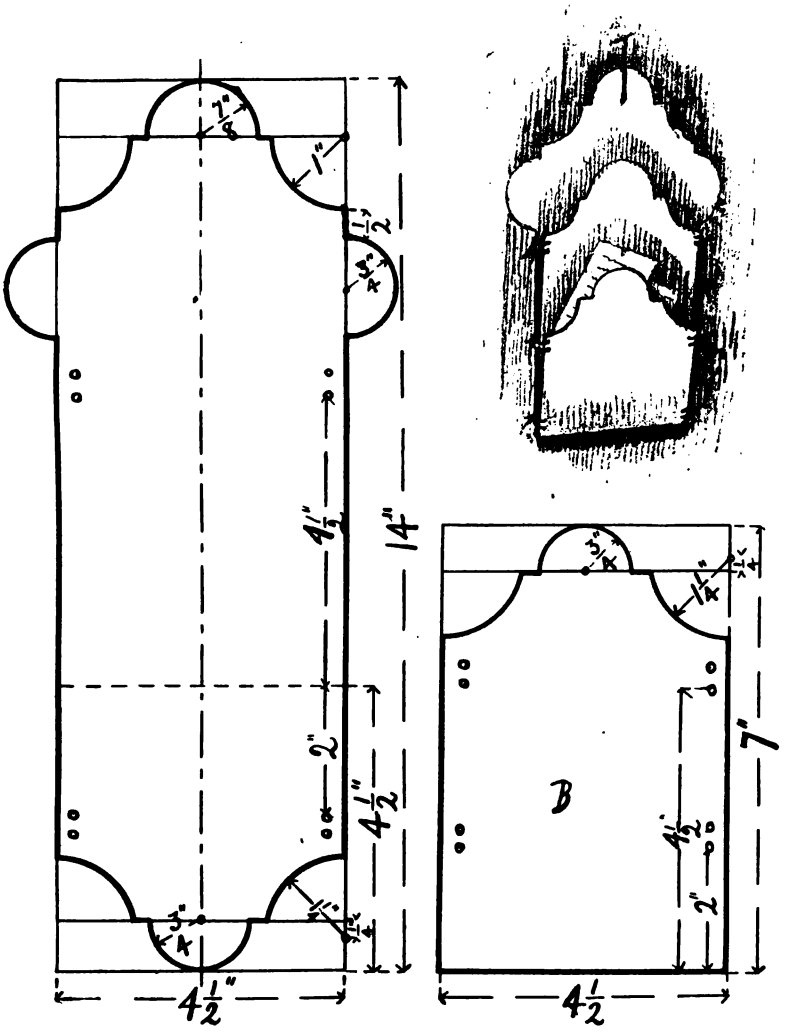
1. Construct rectangle $7\frac{1}{2}'' \times 5''$.
2. Draw lines parallel with short sides.
3. Locate centres for arcs.
4. Complete according to drawing.

Pocket.

1. Construct rectangle $6'' \times 4\frac{3}{4}''$.
2. Complete according to drawing.
3. When punching holes put the two parts together.
4. The laps are folded towards the side which is to be the outside of the pocket when fastened to the back.

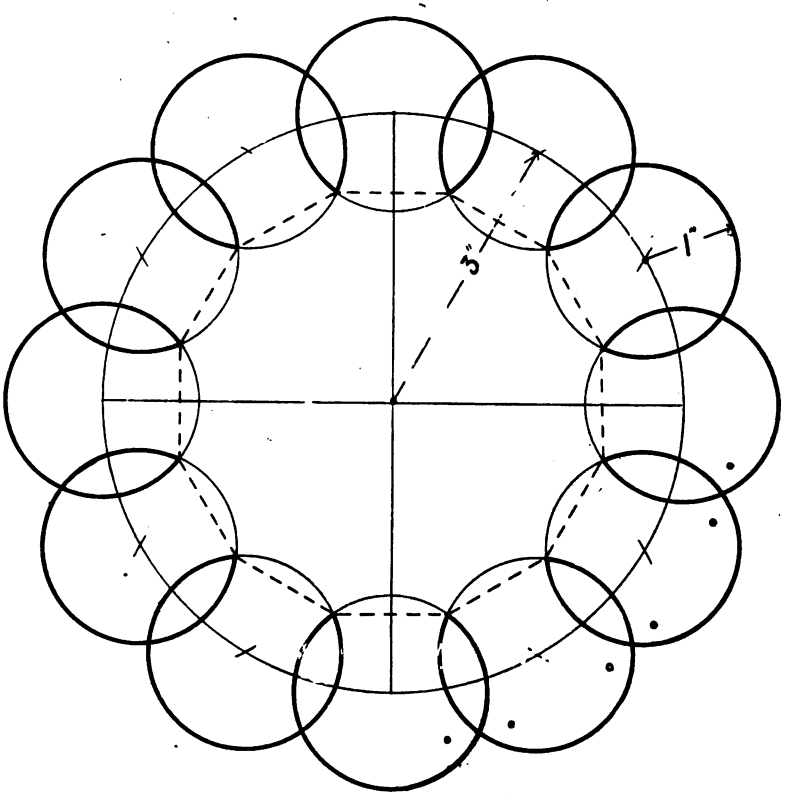


1. Construct the outside rectangle $5\frac{1}{2}'' \times 4\frac{1}{2}''$.
2. Draw the lines parallel to the sides, forming inside rectangles.
3. Construct laps AD and C.
4. In constructing lap B find the centre of ab, draw cd and ce; with a and b as centres and radius $1\frac{1}{4}''$ describe arcs; complete the curves freehand.



1. Construct rectangle $14'' \times 4\frac{1}{2}''$.
2. Draw lines $\frac{7}{8}''$ and $\frac{3}{4}''$ from each end respectively.
3. Find the centre of each of these lines, and describe the semi-circles.
4. Locate the centres for the arcs and complete drawing.

NOTE. — Part B will form another pocket, its lower edge reaching down to the folding line between the two other parts.



1. Describe a circle 3″ radius.
2. Draw two diameters at right angles.
3. With each end of the diameters as centres set off radius (3″) on the circumference.
4. With the twelve points as centres, and 1″ radius, describe circles.
5. Connect the inner intersection points of each of these circles.
6. Cut on the circumference of each of these small circles to the dotted line.
7. To fasten laps together, weave a lacing ribbon or string in and out through the holes in the laps. Have the ribbon cross adjoining laps on the inside of the basket.

NOTE. — Before drawing the circles be sure that the diameters are at right angles.

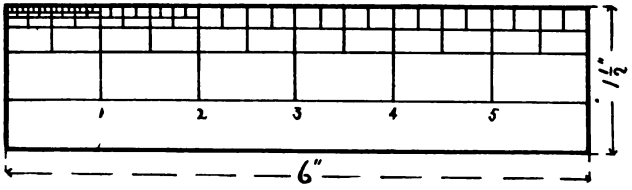
SECOND YEAR.

PLAN OF THE EXERCISES.

SECOND YEAR.

Exercises.	Models.
Cutting, Folding, Pasting.	No. 1. Rule.
	" 2. Napkin Ring.
	" 3A. Money Bag.
	" 3B. Money Bag, with Cover.
	" 4. Match Scratcher.
	" 5. Lamp Shade.
	" 6. Calendar Stand.
	" 7A. Envelope.
	" 7B. Cabinet Envelope.
	" 8A. Small Frame.
	" 8B. Cabinet Frame.
Cutting, Folding, Pasting, Scoring.	" 9. Square Box.
	" 10. Pencil Tray.
	" 11. Basket.
	" 12. Cube.
	" 13A. Handkerchief Box.
	" 13B. Card Case.
	" 14A. Triangular Box.
	" 14B. Stamp Box.
	" 15. Portfolio.
	" 16. Round Box.
	" 17A. Match Holder.
	" 17B. Match Holder.
	" 18A. Box with Cover.
	" 18B. Sliding Box.
	" 19A. Hexagonal Tray.
	" 19B. Hexagonal Tray.
	" 20. Pencil Box.
	" 21A. Card Case.
	" 21B. Photograph Case.
	" 22. Brush-Broom Holder.
	" 23A. Bill Holder.
	" 23B. Wall Case.
	" 24. Paper Holder
	" 25. House.

No. 1. RULE. Second Year.

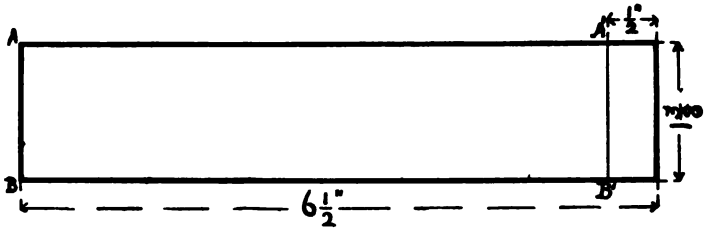


This lesson is intended for a review, and may be drawn on paper only.

For construction, see drawing, and Models 1 and 16, first year.

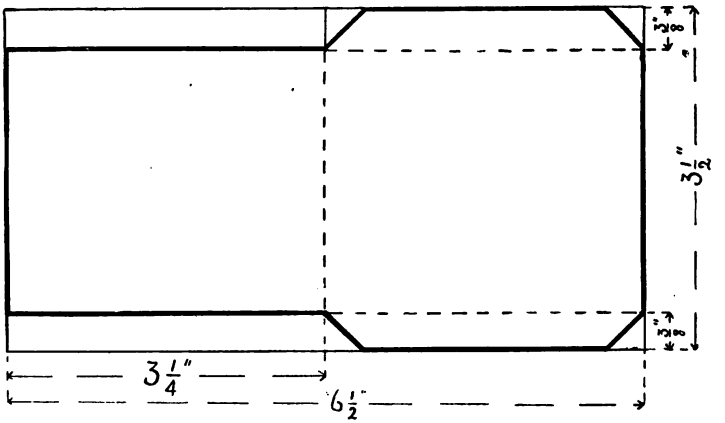
The fraction $\frac{1}{16}''$ is added and may be drawn on one or more inch spaces.

No. 2. NAPKIN RING. Second Year.



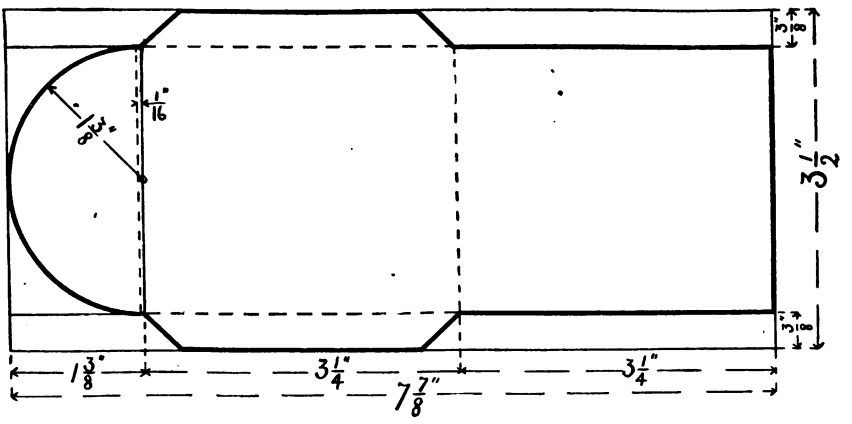
When pasted line AB will coincide with A′B′.

No. 3A. MONEY BAG. Second Year.



1. Construct rectangle $6\frac{1}{2}'' \times 3\frac{1}{2}''$.
2. Draw lines inside rectangle, making the outline of the figure with heavy lines, and using dotted lines to indicate folding.
3. The laps in this and all the following models are $\frac{3}{8}''$ wide, and at 45° to the dotted line, unless otherwise mentioned. (These laps may be made at 60° or 30° if that triangle is used.)
4. Paste laps inside of bag.

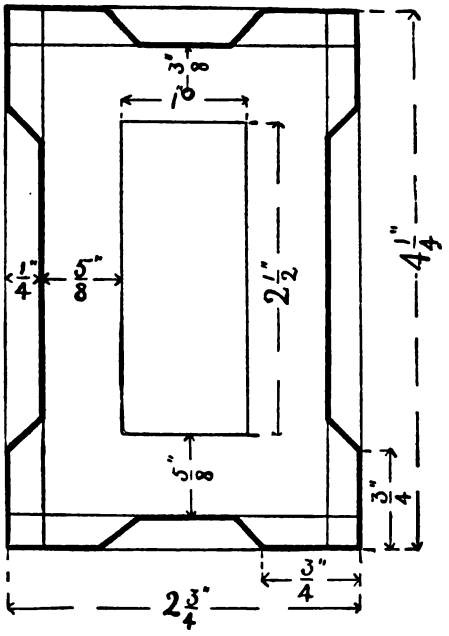
No. 3B. MONEY BAG. Second Year.



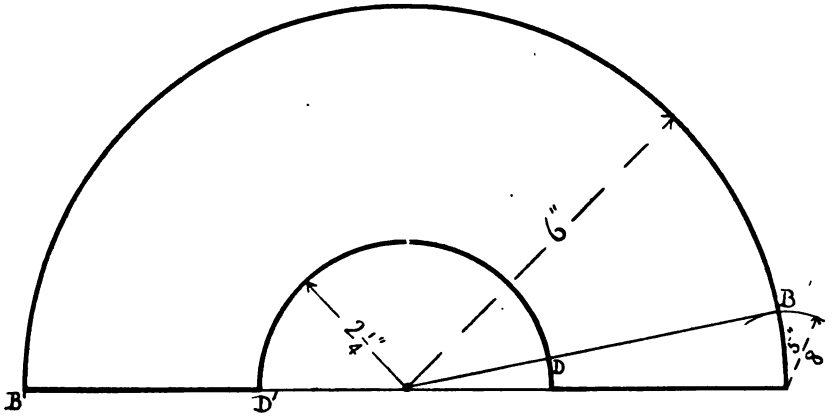
1. Construct rectangle $7\frac{7}{8}'' \times 3\frac{1}{2}''$, and complete drawing like the previous model.
2. In drawing the covering lap, notice that it is folded $\frac{1}{16}''$ above the diameter of circle.

No. 4. **MATCH SCRATCHER.** Second Year.

1. Construct outside rectangle.
2. Draw lines inside $\frac{1}{4}''$ from the sides.
3. Measure off $\frac{3}{4}''$ from each corner on each side of the outside rectangle.
4. Mark off $1''$ on the lines drawn inside, measuring from the outline.
5. Connect corresponding points (see drawing).
6. Draw small rectangle, defining place for the sandpaper.



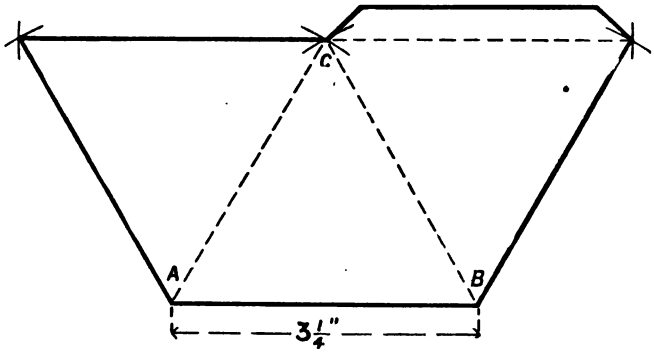
No. 5. **LAMP SHADE.** Second Year.



1. When pasted B′D′ will coincide with BD.

LIBRARY OF THE UNIVERSITY OF

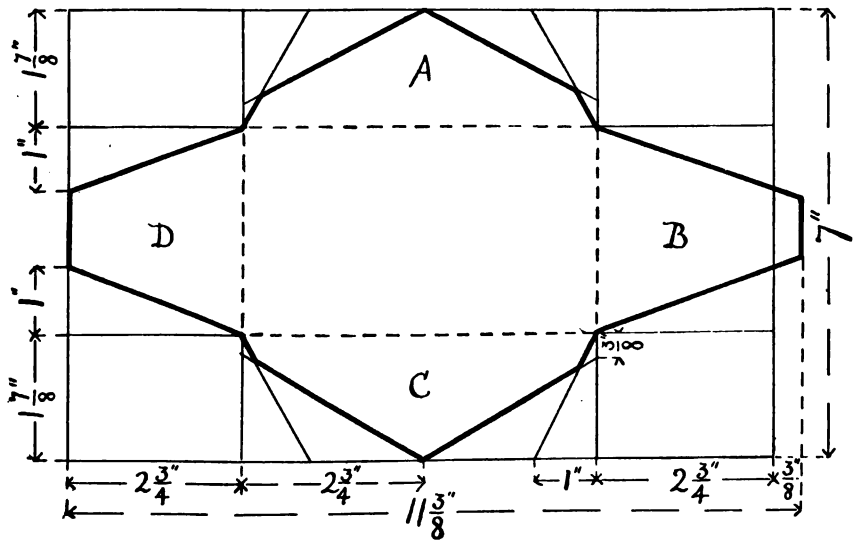
No. 6. CALENDAR STAND. Second Year.



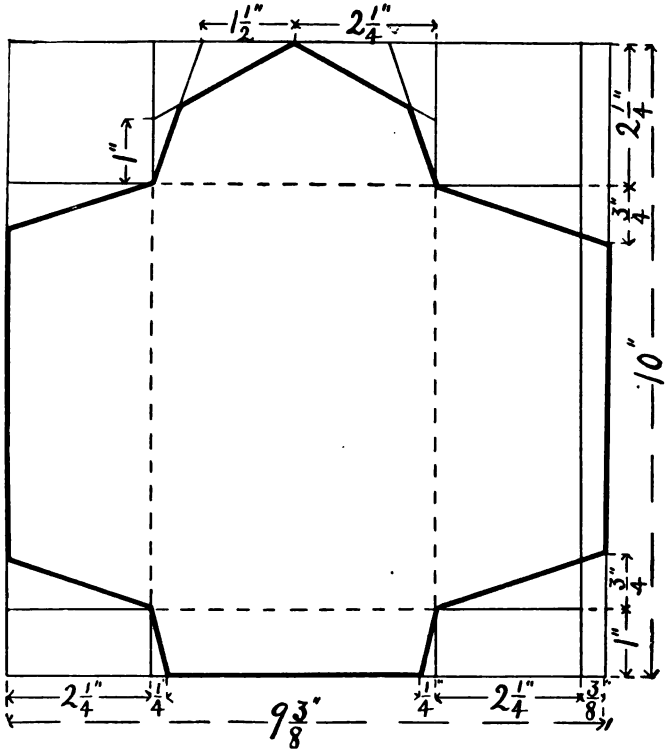
Construct an equilateral triangle on AB, and then on AC and on BC.

NOTE. — The size of this model may be modified according to the size of the calendar.

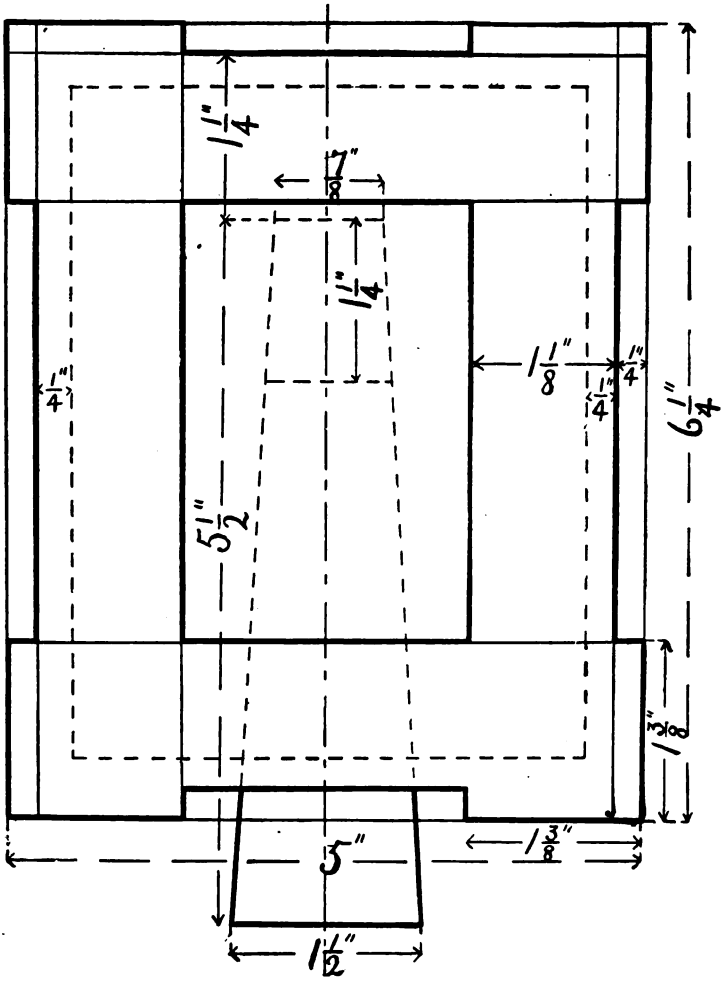
No. 7A. ENVELOPE. Second Year.

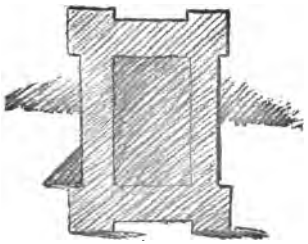


1. Construct 11″ × 7″ rectangle and draw the lines inside parallel to sides.
2. Drawings of laps A and C are similar.
3. Construct lap B similar to lap D, then extend on lap B oblique lines $\frac{3}{8}$″ beyond the rectangle and connect.
4. Fold B first, D second, and C third. When pasted, apex of lap C should come directly in the centre just over edge of lap D.

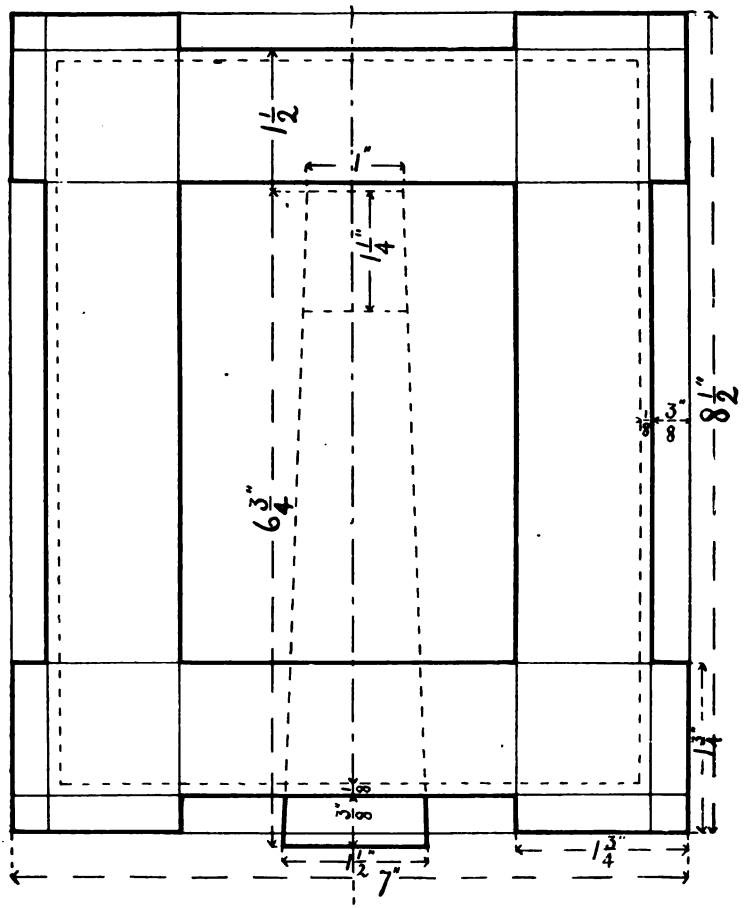


See previous model.



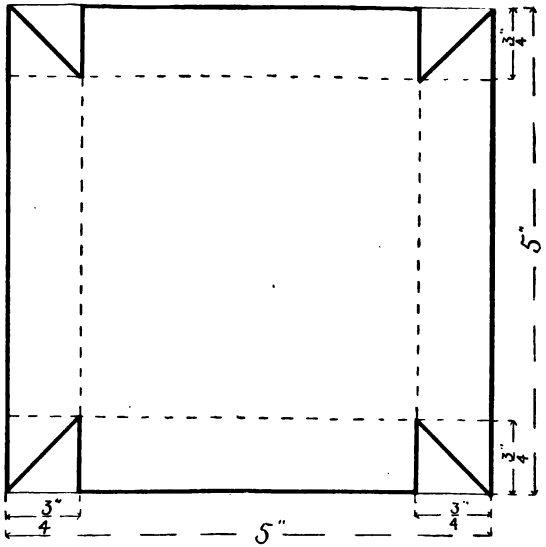


1. Construct rectangles and measure off for the corners.
2. The back and part of the support are indicated in the drawing by dotted lines, the edges being invisible.
3. The back, which is $5\frac{1}{4}'' \times 4''$, may be made of paper.
4. The support is a separate piece of cardboard.



For construction see previous model.

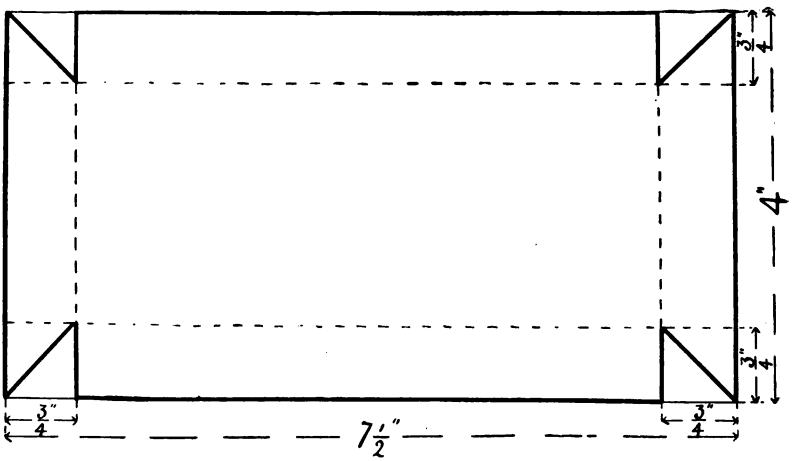
No. 9. SQUARE BOX. Second Year.



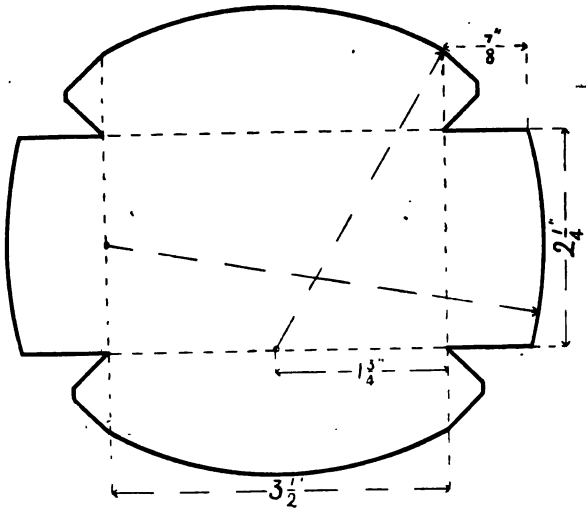
1. Construct large square.
2. Draw lines inside parallel to sides.
3. Draw diagonal in each small square thus obtained

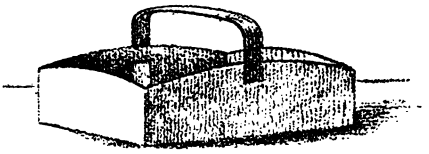
NOTE. — On this and following models the broader point of the scissors is used for scoring; that is, the folding is facilitated by cutting half through the cardboard, the broader point of the scissors having been sharpened for the purpose. (See page 10.)

No. 10. PENCIL TRAY. Second Year.



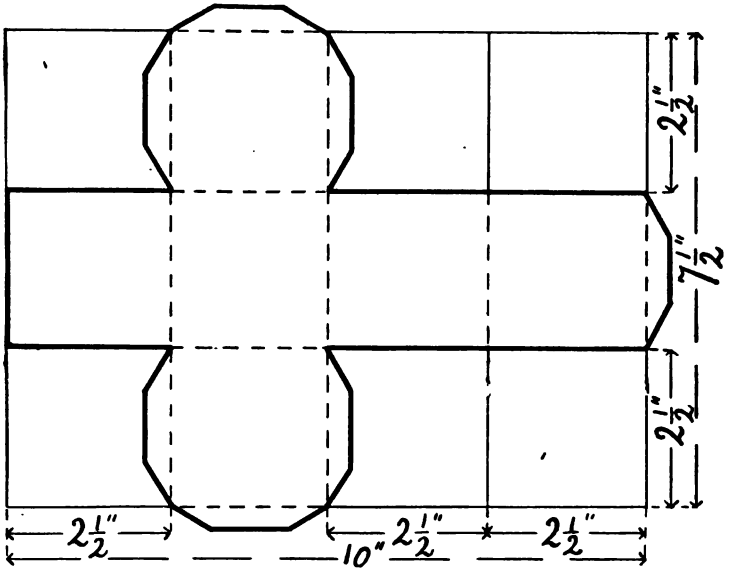
No. 11. BASKET. Second Year.



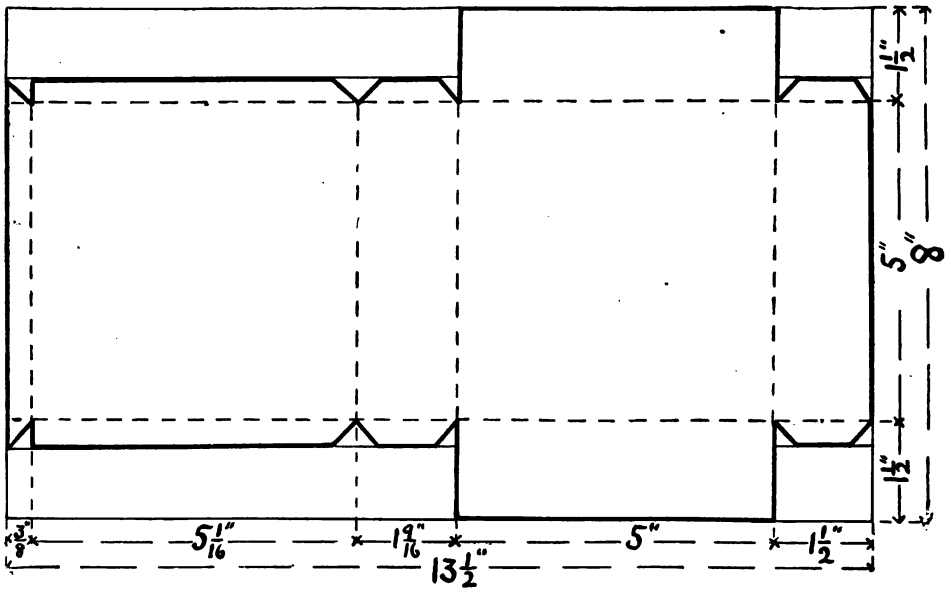


1. Construct rectangle $3\frac{1}{2}'' \times 2\frac{1}{4}''$.
2. Extend sides of rectangle $\frac{7}{8}''$.
3. The centres of the sides of the rectangle are also the centres of the arcs forming the outline of the opposite side of the box. (See drawing.)
4. Make handle $5'' \times \frac{3}{8}''$ and fasten as shown in sketch.

No. 12. CUBE. Second Year.



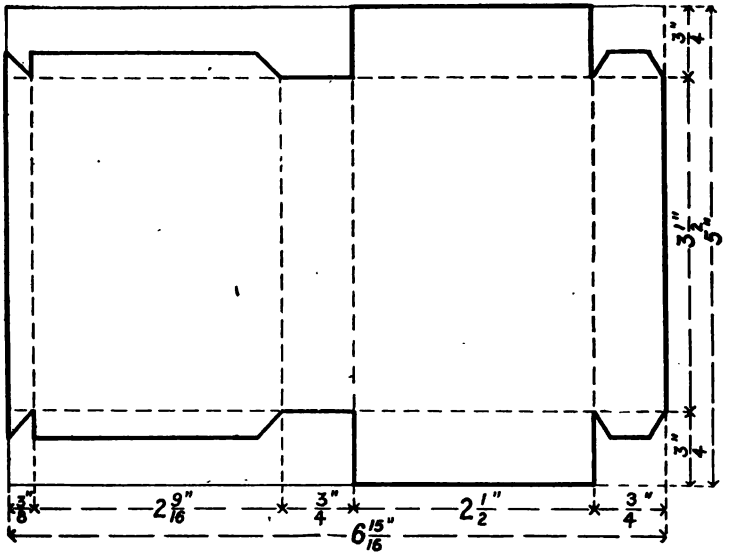
This model may be used for a bank by cutting a small opening in one of the sides. The point of the scissors may be used for this cutting.



1. For construction see Model 27, First Year.
2. Draw laps.

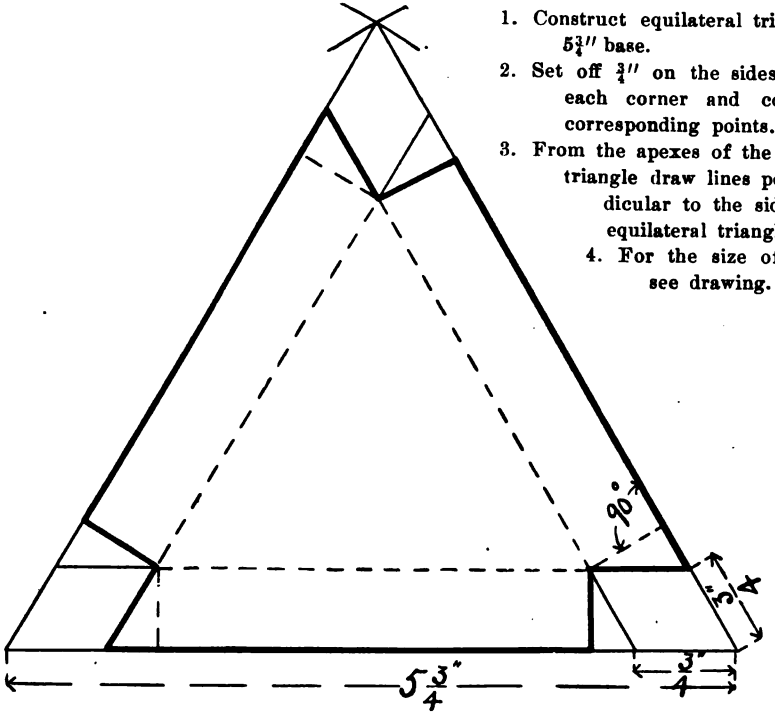
NOTE. — When pasted the cover will overlap the sides of the box.

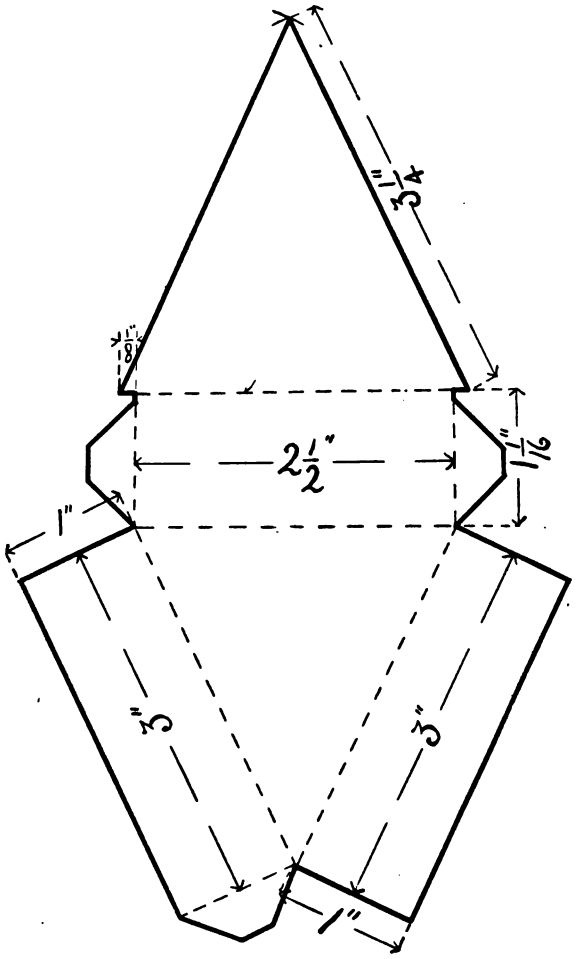
No. 13B. CARD CASE. Second Year.



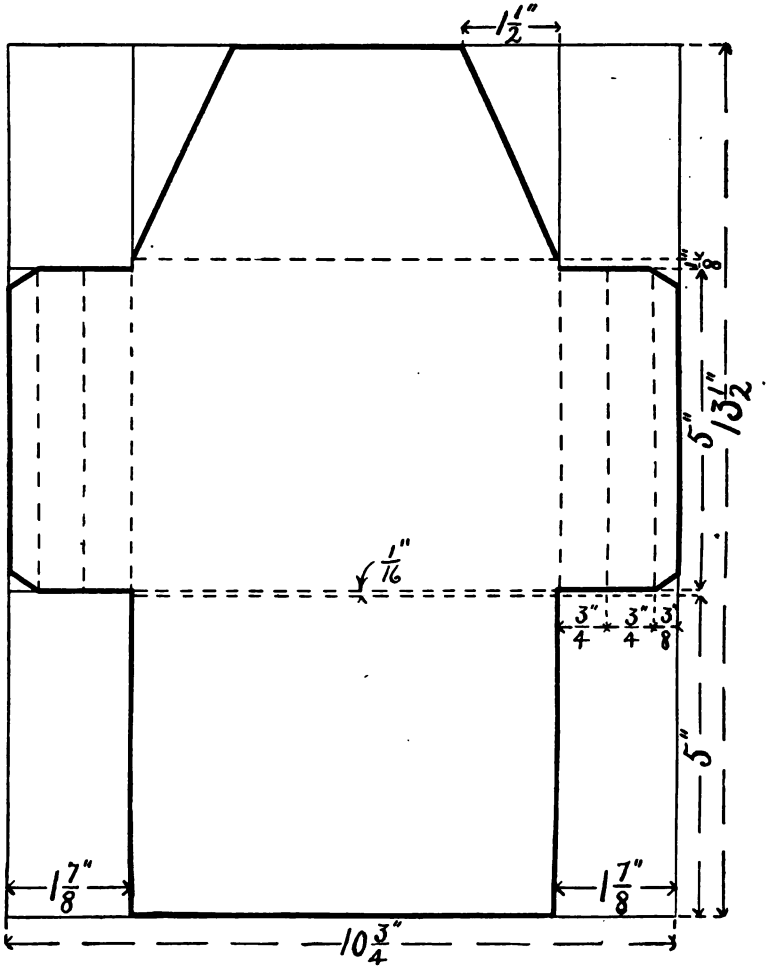
No. 14A. TRIANGULAR BOX. Second Year.

1. Construct equilateral triangle, $5\frac{3}{4}$" base.
2. Set off $\frac{3}{4}$" on the sides from each corner and connect corresponding points.
3. From the apexes of the inner triangle draw lines perpendicular to the sides of equilateral triangle.
4. For the size of laps see drawing.

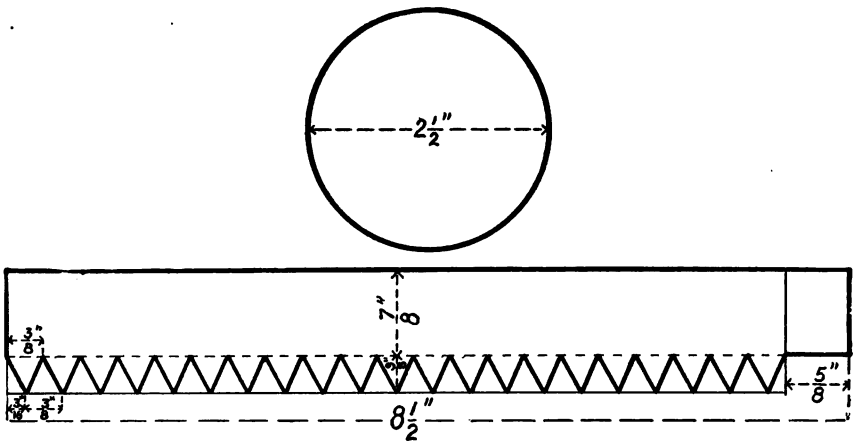




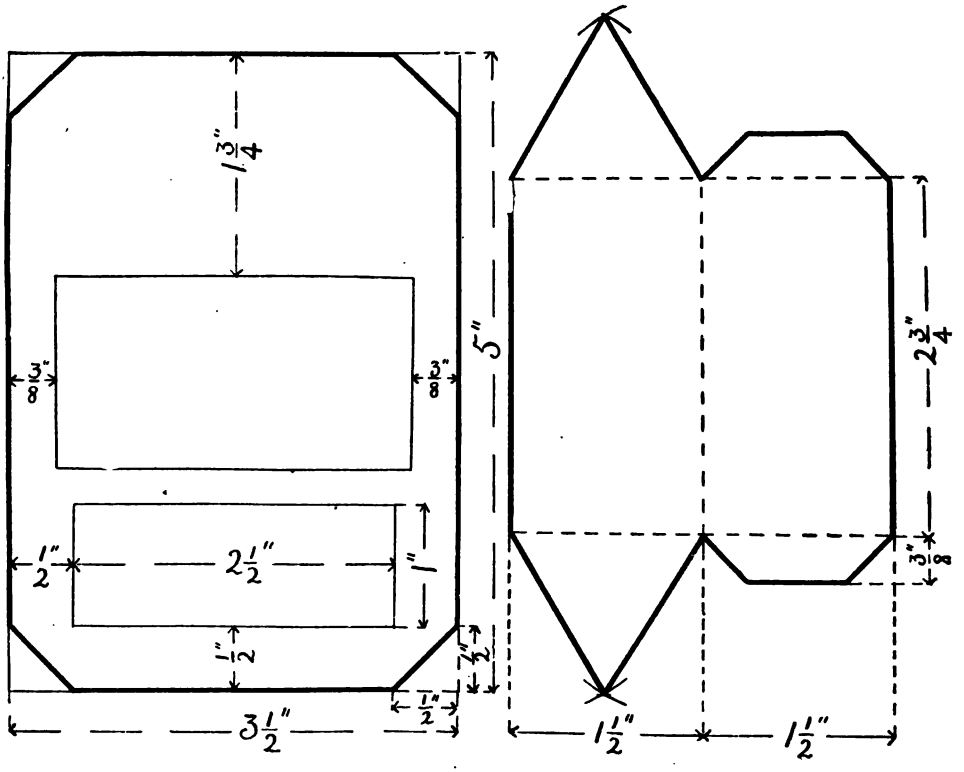
1. Construct the isosceles triangle $3'' \times 3'' \times 2\frac{1}{2}''$.
2. Draw the lines perpendicular to the sides, extending one inch.
3. Connect and draw laps.
4. On the side where the cover is attached $\frac{1}{16}''$ is added to the $1''$ lines; thus the cover is folded on a line $1\frac{1}{16}''$ from the bottom of the box.
5. The cover overlaps $\frac{1}{8}''$ beyond the edge of box.



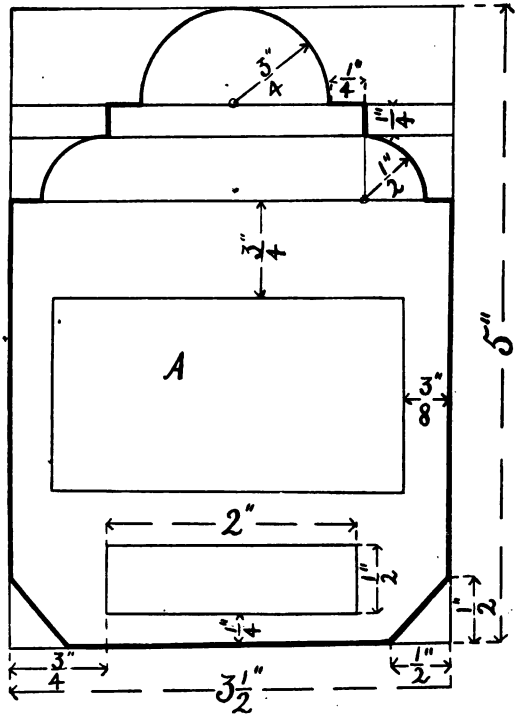
1. Construct rectangle $13\frac{1}{2}'' \times 10\frac{3}{4}''$ and complete according to drawing.
2. The lap forming the cover is folded on a line $\frac{1}{8}''$ above the edge of the pocket; the bottom of pocket is $\frac{1}{16}''$ wide.

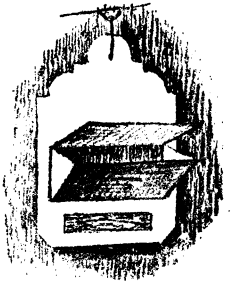


1. Construct rectangle $8\frac{1}{2}'' \times 1\frac{1}{4}''$ and draw the laps.
2. When the ends of this piece have been pasted, the bottom is put inside, the laps being pasted on its bottom surface.
3. Make another circular piece with diameter $\frac{1}{16}''$ larger, and paste it on to the other bottom piece outside the box.



1. For the construction of back see drawing.
2. The pocket will require a piece of cardboard 6″ × 3½″.
3. Draw the oblong 3″ × 2¾″.
4. Find centres of 3″ sides and connect.
5. Construct equilateral triangles and laps.
6. The place for the pocket is indicated by the larger rectangle on the back. The smaller rectangle shows the place for a piece of sandpaper.





Back:

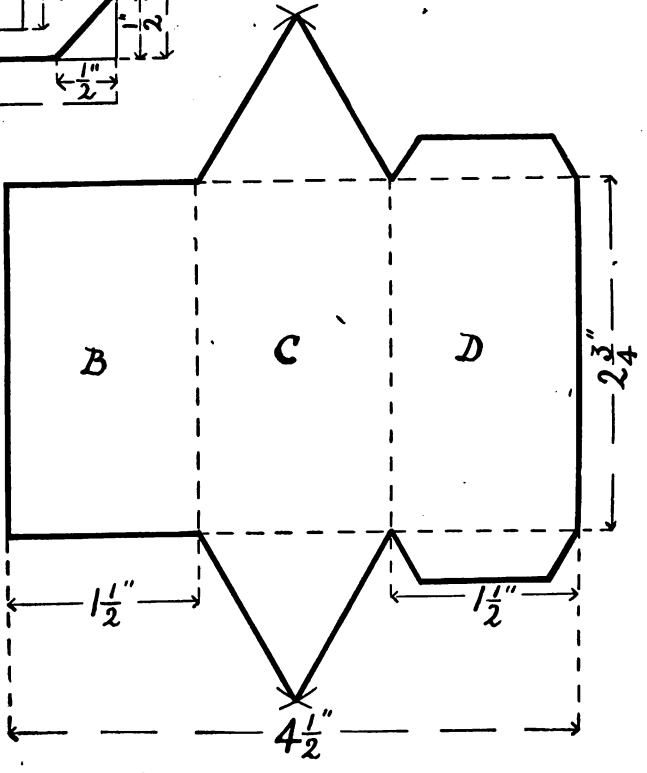
1. Construct rectangle 5" × 3½".
2. Draw the lines parallel to sides.
3. Find centres for arcs and complete outline.

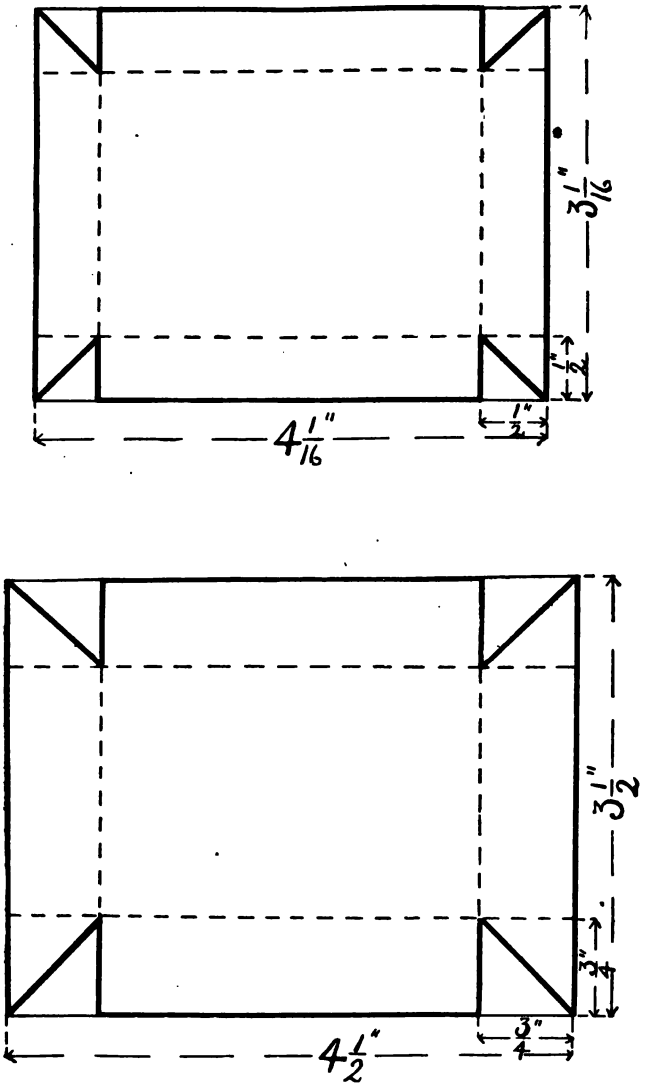
Pocket:

1. This part will require a piece of cardboard 6" × 5".
2. Draw rectangle 4½" × 2¾".
3. Draw lines parallel to short sides of rectangle and construct equilateral triangles and laps.

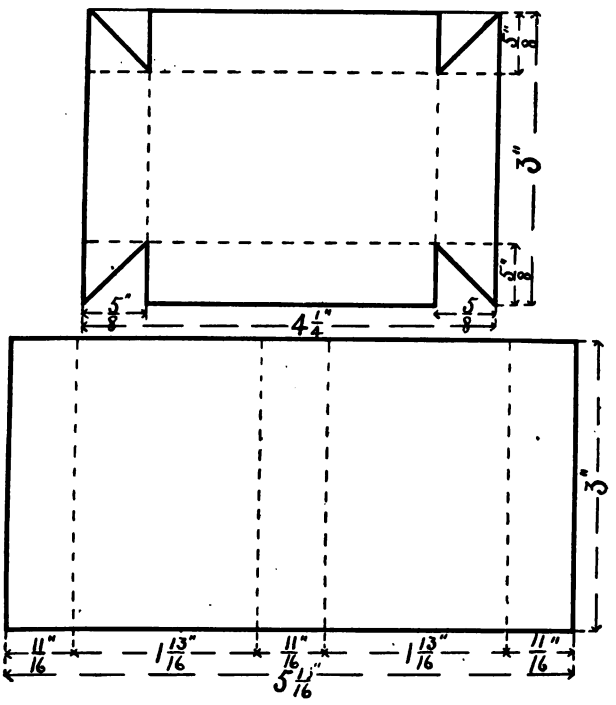
Note.—The pocket is pasted to the back by surface C.

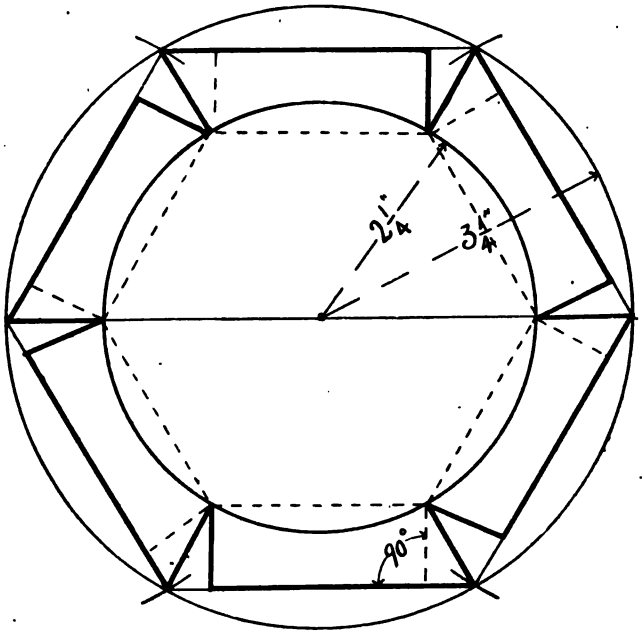
The surface marked B serves as a cover.



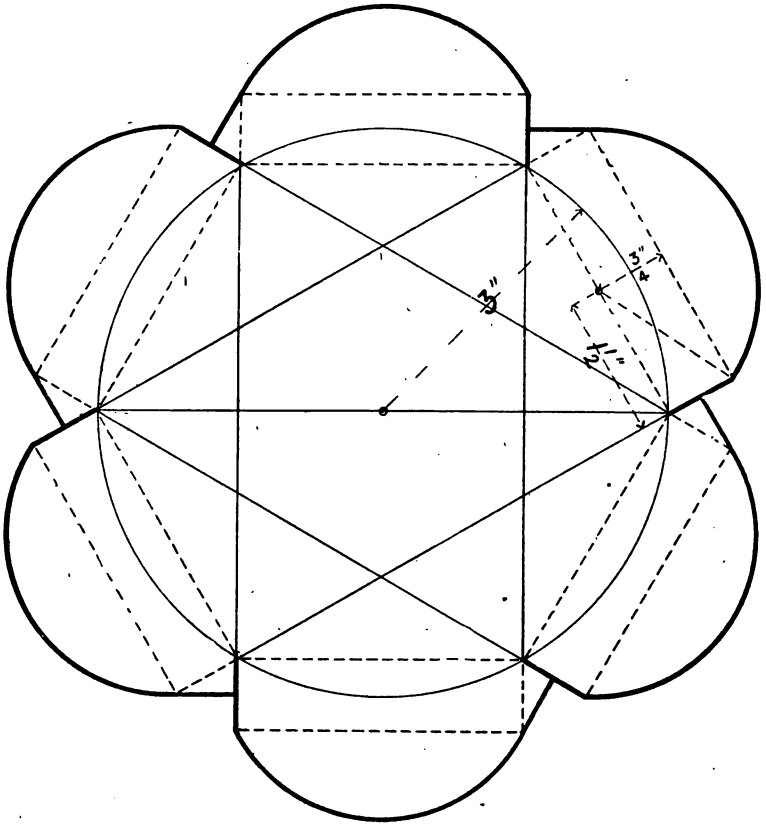


For construction see Model 9, Second Year.

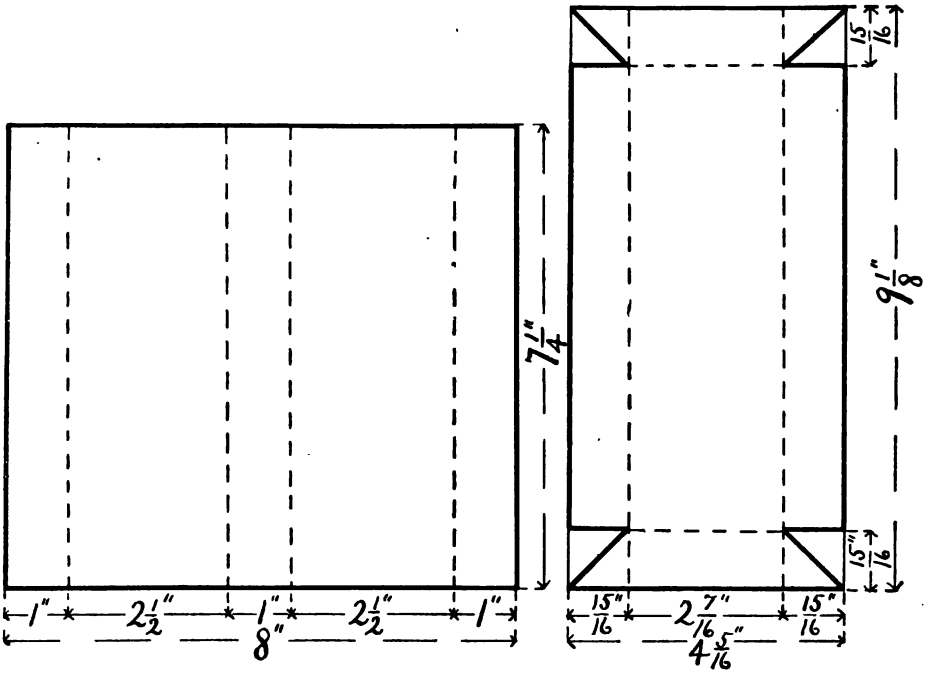

3/8"
3"
3/8"
5/8"
4 1/4"
5/8"
3"
11/16"
1 13/16"
11/16"
1 13/16"
11/16"
5 11/16"



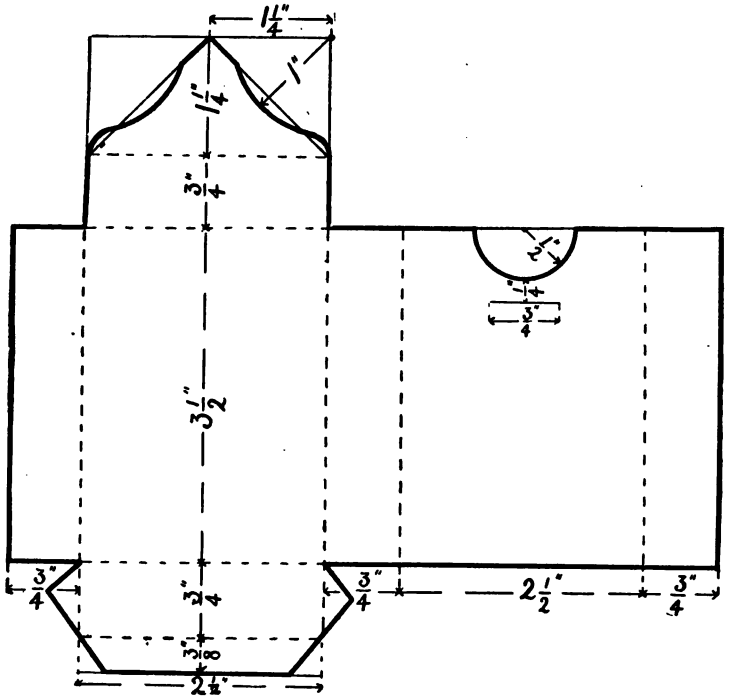
1. Describe circles, radii $2\frac{1}{4}$" and $3\frac{1}{4}$" respectively.
2. Inscribe the hexagons and draw the lines defining the sides of the box. (See Model 32, First Year.)
3. For size of laps see drawing.



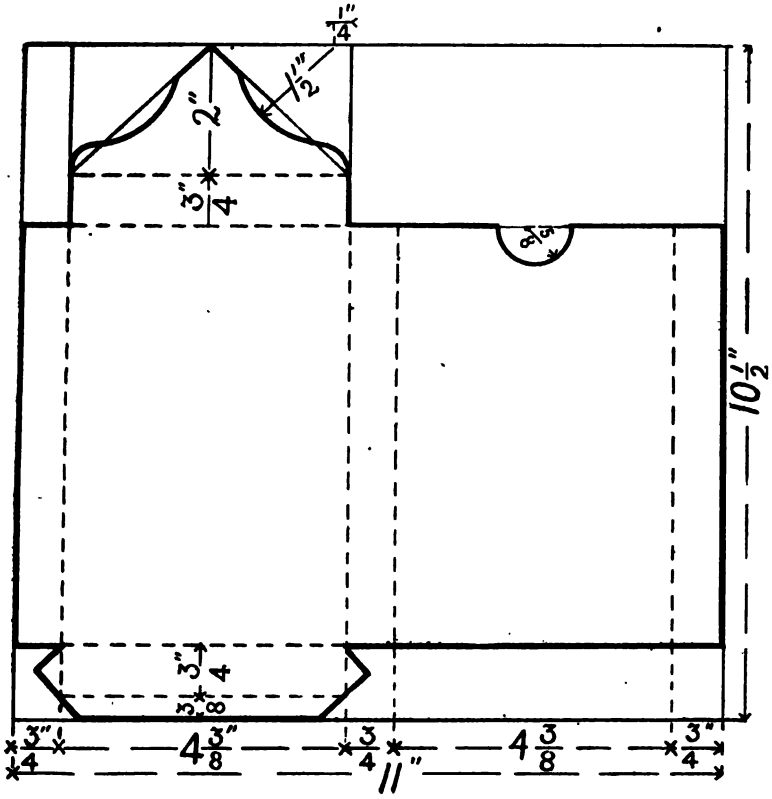
1. For construction see previous model and No. 32, First Year.



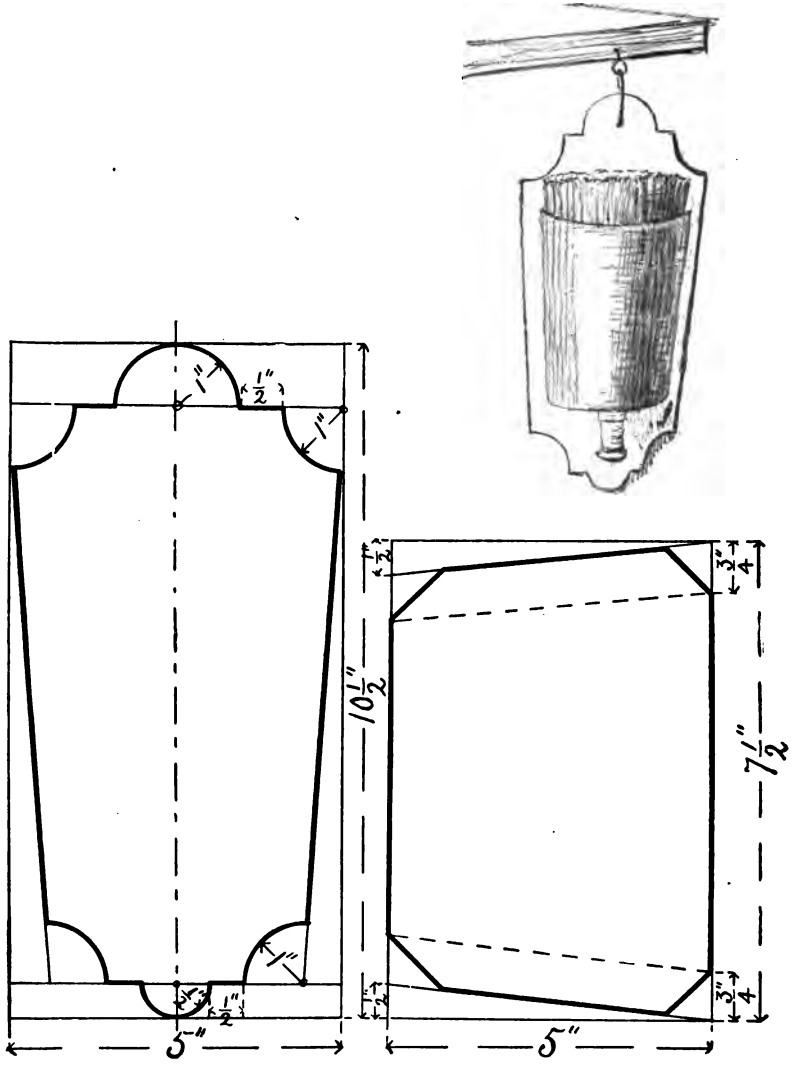
NOTE. — Partitions, one lengthways in the middle of the box, with laps attached to the ends and bottom, and another across the one-half of the box, may be made as illustrated in sketch.



1. Construct rectangle $7\frac{1}{4}'' \times 6\frac{5}{8}''$ and draw lines inside parallel to sides.
2. For construction of the covering lap see No. 37, First Year.

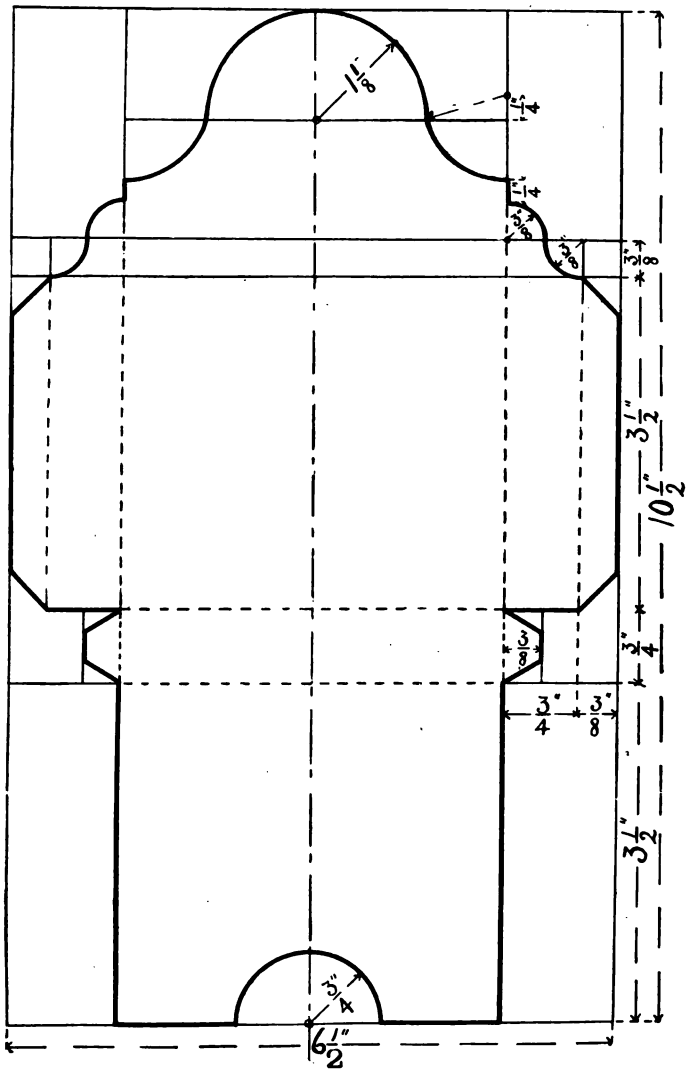


See previous model.

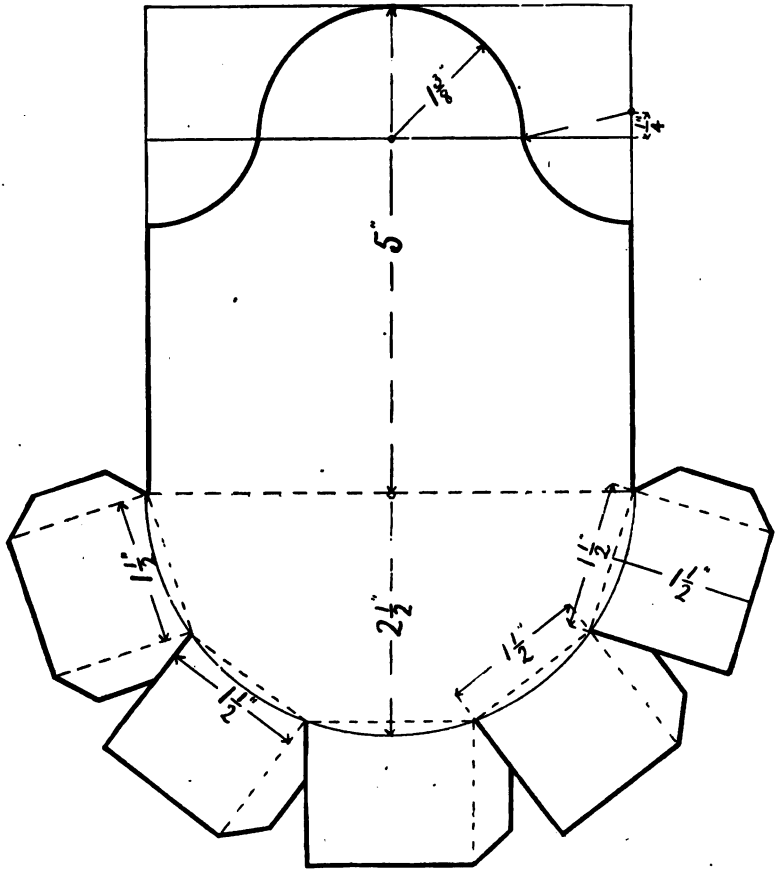


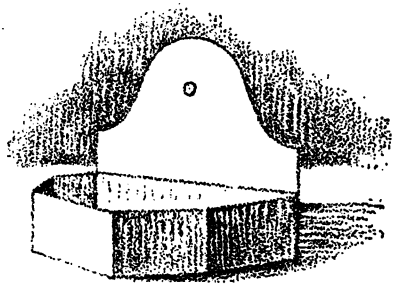
For construction see Model 39, First Year.

NOTE. — In this model paste pocket to back with laps inside.

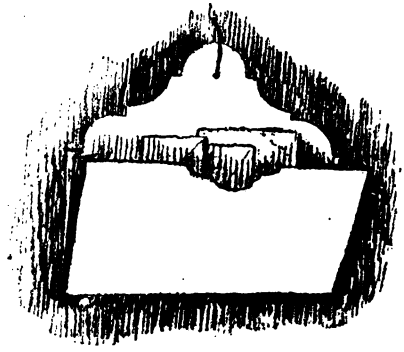


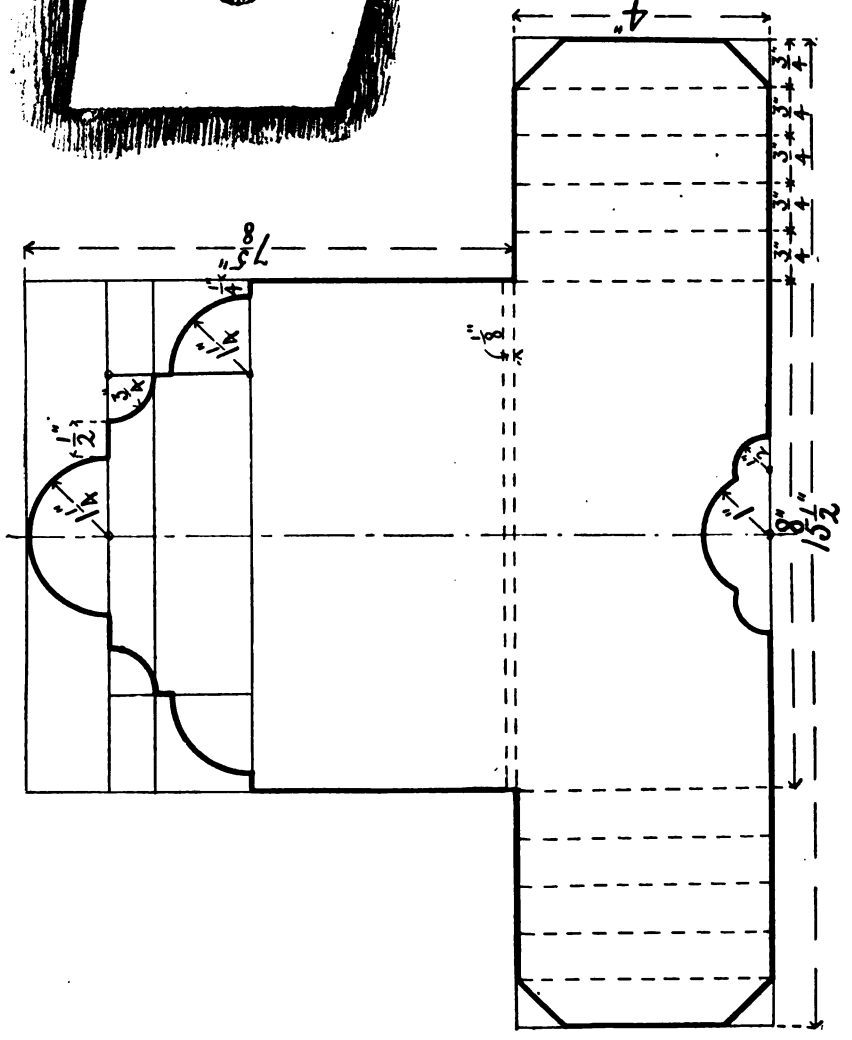
1. Construct rectangle $10\frac{1}{2}'' \times 6\frac{1}{2}''$.
2. Draw lines inside rectangle parallel to sides.
3. Describe arcs.

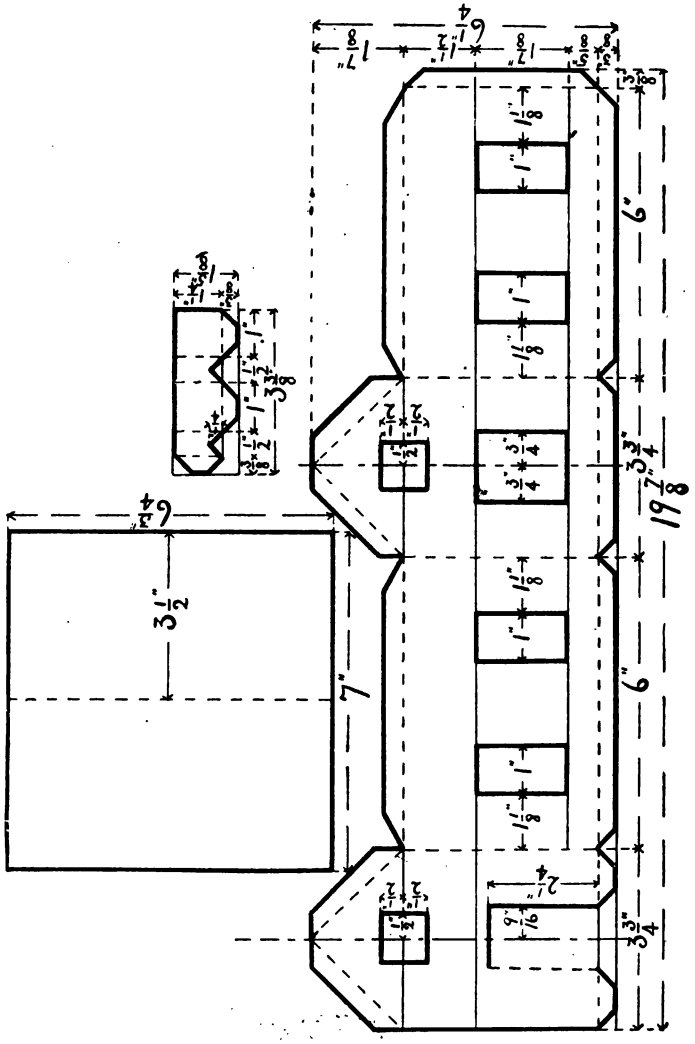


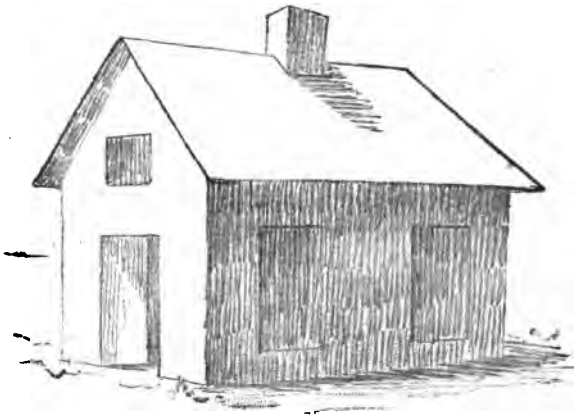


1. A piece of cardboard $9\frac{1}{2}'' \times 8\frac{1}{2}''$ is required for the model.
2. Construct square 5″.
3. Find centre of one of the sides and decribe large semicircle.
4. Set off on the circumference two spaces $1\frac{1}{2}''$ each from each end of diameter.
5. Connect adjoining points.
6. Erect perpendiculars from these points to each of the lines just drawn.
7. Measure off $1\frac{1}{2}''$ on the perpendiculars and connect.
8. Make drawing of laps and the part forming the back.




4"
7⅝"
⅛"
1¼"
3"
1½"
1¼"
1"
8"
15½"


6 1/4"
1 7/8"
1 1/2"
1 7/8"
1 1/8"
1"
1 1/8"
1"
1 1/8"
1"
1 1/8"
1"
6"
6"
3 3/4"
19 7/8"
3 3/4"
2 1/4"
3 3/4"
6 1/4"
3 1/2"
7"
3/4"
3/4"
1/2"
1/2"
1/2"
1/2"
1"
1"
3 3/8"



1. The smaller detail drawings represent the roof and the chimney.
   This model may be made very interesting by adding decorations suggested by teacher.
   The blinds may be indicated in pencil on the house.
   Roof, chimney, door, and blinds may be tinted in water color if it is accessible.
   Awnings of paper may be made for windows, the glass of the latter represented by mica, and, if the house is pasted on to a stiff piece of cardboard or cover of a pasteboard box, a yard may be suggested.

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